ASSESSING THE READINESS OF PUBLIC HEALTHCARE FACILITIES TO ADOPT HEALTH INFORMATION TECHNOLOGY (HIT)/E-HEALTH: A CASE STUDY OF KOMFO ANOKYE TEACHING HOSPITAL, GHANA

A Thesis submitted by

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Abstract

Most health information technology (HIT)/e-Health initiatives in developing countries are still in project phases and few have become part of routine healthcare delivery due to the lack of clear implementation roadmap. Ghana has been piloting a number of e-Health initiatives, which have not guaranteed a sustainable implementation of such systems. The objective of this research study was to explore the information technology (IT) readiness of public healthcare institutions (primary, secondary and tertiary) in Ghana to adopt e-Health in order to develop a standard HIT/e-Health readiness assessment model. For a population of 28,678,251 people there are only 2,615 medical doctors on the Ministry of Health's (MoH) payroll as at 2013 and 1818 public hospitals. Consequently, the doctor to population ratio is extremely low as compared to other developing countries, which falls far below the WHO revised standard of 1:600. Under these circumstances there is evidence in developed countries that adoption of health informatics technologies can contribute to improving the situation. An extensive review of literature on e-health in developing countries has identified a general lack of adoption due to a lack of readiness to incorporate the technology into the healthcare environment. Literature provides myriad but fragmented models/frameworks of health information technology (HIT)/e-Health adoption readiness assessment limited measuring tools to assess factors of HIT readiness. This risks the outcomes of HIT/e-Health readiness assessment, which eventually limits knowledge about the strategic gaps warranting the need for the implementation of HIT/e-Health systems in public healthcare institutions in Ghana. Whiles previous studies acknowledge the existence of HIT readiness assessment factors, there exist very limited measuring items for these factors. Simply put, there is not just limited studies on HIT readiness assessment, but there is also no standard guiding readiness assessment model. This study has identified the lack of standard assessment model/framework as well as their accompanying measuring tools for effective outcomes as major gaps. Thus, there was the need for gaining a deeper understanding of existing readiness factors and their applicability in the context of the readiness of public healthcare facilities in Ghana and how they promote or impede HIT/e-Health adoption in order to develop standard HIT readiness assessment model, which comprises readiness factors and most importantly their measuring tools.

This study used a mixed method approach, specifically the exploratory sequential design (the exploratory design) where the outcome of qualitative data collected from 13 senior health CIOs and leaders of e-Health initiatives in Ghana analysed built to quantitative data collection instrument. The survey instrument was used to collect quantitative data from 298 clinical and

non-clinical staff (Administration/Management leadership) Komfo Anokye Teaching Hospital (KATH) in a form of case study to confirm the findings of the initial exploratory study. This was because the mixed method is rooted in the pragmatism of philosophical assumptions, which guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases of the research process. Furthermore, mixed research methods design strategy provides a powerful mechanism for IS researchers in dealing with the rapidly changing environment of ICT.

An initial standard regression analysis using IBM SPSS version 23 established that five factors (*Technology readiness (TR); Operational resource readiness (ORR); Organizational cultural readiness (OCR); Regulatory policy readiness (RPR);* and *Core readiness (CR)*) and 63 indicators (measuring tools) promote and/or impede HIT/e-Health adoption readiness in public healthcare facilities in Ghana. Consequently, these factors were used in developing a standard HIT readiness assessment model. Whiles these five factors all proved to have strong association with the dependent variable Health Information Technology readiness (HITR) in the standard regression, (R^2 = 0.971) the findings of a latter PLS-SEM, an advanced regression analysis deployed suggest that *Regulatory policy readiness (RPR)* and remarkably *Core readiness (CR)* did not impact on the readiness of KATH to adopt e-Health/HIT. As many public healthcare organizations in Ghana have already begun the process of implementing various HIT/e-Health systems without any reliable HIT/e-Health regulatory policy in place, there is a critical need for reliable HIT/e-Health regulatory policies (RPR) and some improvement in HIT/e-Health strategic planning (core readiness). The final model (R^2 = 0.558 and Q^2= 0.378) suggest that TR, ORR, and OCR explained 55.8% of the total amount of variance in health information technology/e-Health readiness in the case of KATH, partially supporting the hypotheses of this study. Although no formal hypotheses were proposed for the relationships/effects, which exist between exogenous/independent constructs in the model structure, the SmartPLS3 model path analysis did show that there exist such relationships. For instance, the significant paths from regulatory policy readiness (RPR) to organizational resource readiness (ORR) (t = 23.891; *Beta* = 0.774) and from technological readiness (TR) to operational resource readiness (ORR) (t = 11.667; Beta = 0.624) obtained from SmartPLS3 bootstrap procedure indicate the presence of mediation. Fit values (SRMR = 0.054; NFI = 0.739). Generally, the GoF for this SEM are encouraging and can substantially be improved when public healthcare facilities in Ghana intending to implement HIT/e-Health pay equal attention to relevant regulatory policies and strategic planning.

The readiness assessment model developed this study essentially offers a useful basis for healthcare organizations to enhance the conditions under which HIT/eHealth is launched in order to achieve successful and sustainable adoption with particularly attention being paid to HIT/e-Health regulatory policies and strategic planning. When evaluations such as this are carried out effectively, there could be a circumvention of large losses in money effort and time, delays and disappointments among planners, staff and users of services whiles facilitating the process of change in the institutions and communities involved.

This study was conducted with selected subjects and selected public healthcare facilities in the southern cities/parts of Ghana. Therefore, a replication or transfer of this study to other parts of Ghana especially the rural areas and the private healthcare environment should consider the potential differences resulting from varying cultural, socioeconomic and political backgrounds since healthcare is a much-institutionalised industry. The same caution must be exercise when replicating this study in other developing countries and across the globe.

Certification of Thesis

This thesis is entirely the work of ***Salifu Yusif*** except where otherwise acknowledged. The work is original and has not previously been submitted for any other award, except where acknowledged.

Student and supervisors' signatures of endorsement are held at USQ.

Dr Abdul Hafeez-Baig

Principal Supervisor

Professor Jeffrey Soar

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List of publications during this research study

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Manuscripts being peer-reviewed in Q1 Journals

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Yusif, S., Hafeez-Baig, A. and Soar, J. 2017Ms JBI-17-504 Towards developing a "normative" health information technology readiness assessment framework

Yusif, S., Hafeez-Baig, A. and Soar, J. 2017CTWQ-2017-0054 The paradox of hope: An alternate perspective to Africa’s digital divide

Yusif, S., Hafeez-Baig, A. and Soar, J. IJMI-D-17-00440 Testing the reliability of measurement instruments for health information technology (HIT) readiness assessment factors

Abbreviations

ACCORD	Australian Centre for Country of Origin and Asylum Research and Documentation
ACDEP	Association of Church-Based Development NGOs in Northern Ghana
AVE	Average Variance Extracted
BoD	Board of Directors
C- TPB-TAM	Combined Theory of Planned Behavior/Technology Acceptance Model
MPCU	Model of Personal Computer C Utilization
CBSEM	Covariance-Based Structural Modeling Equation
CFA	Confirmatory Factor Analysis
CHRPE	Committee for Human Research and Publication and Ethics
CID	Centre for International Development
CIO	Chief Information Officer
CPOE	Computerized Physician Order Entry
CR	Core Readiness
D&M	Delone and McLean
DCS	Drop and Collect Survey
DF	Degree Of Freedom
DOI	Diffusion of Information
DEENT	Dental, Eye, Ear, Nose And Throat
EFA	Exploratory Factor Analysis
EHR	Electronic Health Record
EHRA	E-Health Readiness Assessment
EMR	Electronic Medical Record
ePHI	Electronic Protected Health Information
EPR	Electronic Patient Record
FA	Factor Analysis
FITT	Fit Between Individuals, Task and Technology
GBD	Global Burden of Disease
GDP	Gross Domestic Product
GHS	Ghana Health Services
GNI	Gross National Income
GoF	Goodness-Of-Fit
HAMS	Health Administration Management System

HCO	Healthcare Organization
HIS	Health Information System
HIT	Health Information Technology
HITR	Health Information Technology Readiness
HIV/AIDS	Human Immune Virus/Acquired Immune Deficiency Syndrome
HMIS	Health Management Information System
HOT-Fit	Human, Organization and Technology-Fit
HTMT	The Heterotrait-Monotrait Ratio of Correlations
IBM SPSS	International Business Machines Statistical Package for the Social Sciences
ICT	Information and Communication Technology
ICT4AD	Information and Communication Technology for Accelerated
IDC	Innovation Diffusion Theory
IDT	Innovation Diffusion Theory
IRIN	Integrated Regional Information Network
IS	Information Systems
IT	Information Technology
ITDP	The Institute for Transportation and Development Policy
ITG	Information Technology Governance
ITU	International Telecommunication Union
KATH	Komfo Anokye Teaching Hospital
KMO	Kaiser-Meyer-Olkin
KNUST	Kwame Nkrumah University of Science and Technology
LMIC	Low and Middle Income Country
M	Median/Mean
MDG	Millennium Development Goals
mHealth	Mobile Health
MM	Motivational Model
MoH	Ministry of Health
MOTECH	Mobile Technology for Community Health
MVP	Millennium Village Program
NGO	Non-Governmental Organizations
NFI	Normed Fit Index
NHIS	National Health Insurance Scheme

NHS	National Health Service
OCR	Organizational Cultural Readiness
OECD	Organization for Economic Co-Operation and Development
OLS	Ordinary Least Square
OpenMRS	Open Medical Record System
ORR	Operational Resource Readiness
PAF	Principal Factoring Axis
PCA	Principal Component Analysis
PDA	Personal Digital Assistant
PhD	Doctor of Philosophy
PLS	Partial Least Square
QUAL	Qualitative
QUAN	Quantitative
RPR	Regulatory Policy Readiness
SCT	Social Cognitive Theory
SD	Standard Deviation
SEM	Structural Modeling Equation
SRMR	Standardized Root Mean Square Residual
TAM	Technology Acceptance Model
TOE	Technology-Organization-Environment
TPB	Theory of Planned Behavior
TR	Technology Readiness
TRA	Theory of Reasoned Action
TTF	Task-Technology-Fit Model
UNDP	United Nations Development Program
UNWCE	United Nations World Commission on Environment
USAID	United States of America Agency for International Development
USQ	University of Southern Queensland
UTAUT	Unified Theory of Acceptance and Used Technology
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

Chapter overview

This chapter provides an overview of Ghana as the research case country. It also presents introductory information about the healthcare institution, healthcare situations and current e-Health initiatives and issues in Ghana. The chapter further provides information about the research focus of this as part of the research context and structure of the thesis.

1.0 Introduction

e-Health is the use of information and communication technologies (ICT) for health (World Health Organization, 2016). e-Health readiness refers to the preparedness of healthcare institutions or communities for the anticipated change brought about by programs related to ICT (Khoja et al. 2007). e-Health initiatives in Ghana such as the millennium village program (MVP); Mobile Dermatology; and Sene personal digital assistant (PDA) have used ICT/Internet and Mobile phones to provide healthcare services to people in deprived/remote communities (Afarikumah, 2014). With the realization of the importance of healthcare as a key issue for development, governments of many developing countries including Ghana are increasingly interested in investing in e-Health to improve healthcare services for patients, families, care-providers, communities and payers (Khan et al., 2012, Kemper et al., 2006, Middleton et al., 2005, Watson, 2006, Yusif et al., 2013). This is in spite of their recognition as being costly investments (Nguyen et al., 2014). The experience to date has been disappointing when initial high hopes are forced to confront the chaotic and sometimes corrupt health systems in many countries (Lucas, 2008). As with many developing countries there is a lack of technology infrastructure in Ghana (Kisiedu, 1999). There cannot be any meaningful development without effective and efficient telecommunications systems being in place. In Ghana, the need for efficient and reliable telecommunication services has been recognized, and making these services available is vital to Ghana's economic advancement (Salia, 1994).

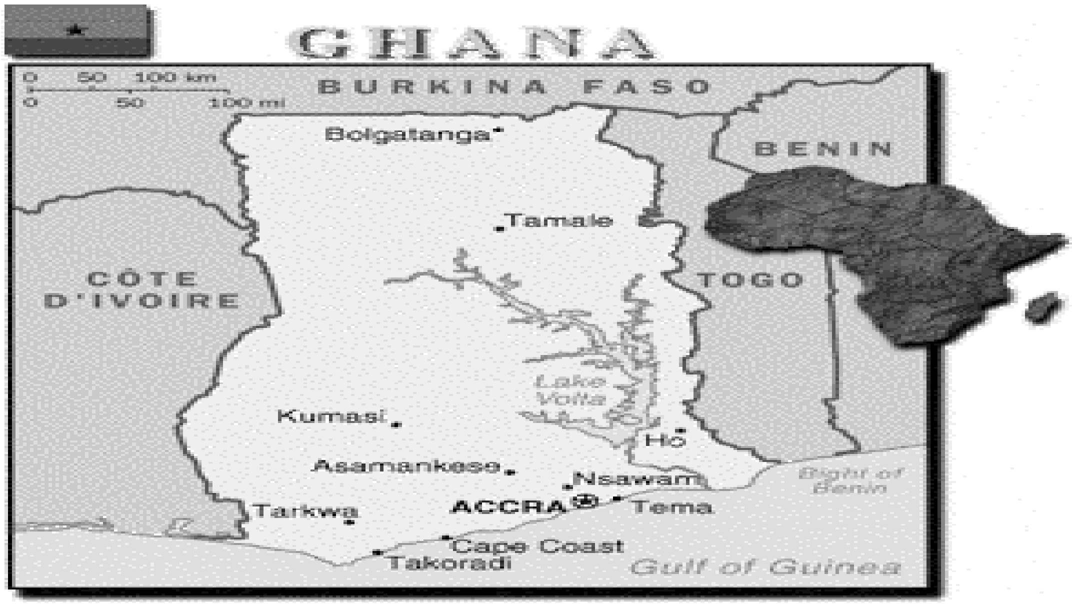
Currently there are about 20 initial small-scaled pilot-based e-Health initiatives in Ghana (Afarikumah, 2014), most of which in one way or another are externally funded/supported. These initial small-scale or pilot-based successes do not guarantee sustainable large-scale adoption and realization of benefits (Latifi et al., 2009). This necessitates the need for an e-

Health readiness assessment among public healthcare institutions intending to adopt similar systems. A healthcare institution in the context of this study refers to public hospitals in Ghana. In this research study, readiness will imply the preparedness of health care institutions in Ghana to adopt e-Health solutions. Long-term outcomes typically depend on factors such as the reliability of sophisticated equipment and availability of technical staff to operate and maintain such equipment. There is also a need for adequate funding to finance normal operating expenses, maintenance costs and frequent upgrades that seem to be an intrinsic feature of ICT systems (Yusif and Soar, 2014).

1.1 Ghana in History

Comprising major ethnic groups including the Akan, Ewe, Mole-Dagbane, Guan, and Ga-Adangbe (GhanaWeb, 2017), Ghana (see figure 1, map of Ghana below) is located on the west coast of Africa is home to over 28,678,251 people (World Population Review, 2017). The country is a multi-party democratic republic and is divided into 10 administrative regions (Oxford Business Group, 2012). Ghana gained independence from British rule on 6 March 1957, and became a republic in the British Commonwealth of Nations on 1 July 1960, the first in the Sub-Saharan African region. Its administrative and political capital is Accra. Ghana has a total land area of 238,537 km^2 (92,100 sq. miles) stretching 672 km north to south and 357 km east to west. Its physical size makes it about the same size as Great Britain (Shadid et al., 2012). Agriculture contributes 34 per cent of the gross domestic product (GDP) and it employs about 50 per cent of the population (Ghana Statistical Services, 2008). In the rural areas of Ghana, illiteracy rates amongst adult men and women stand at 51% and 62% respectively (Ghana Statistical Services et al., 2008).

Figure 1.1: Map of Ghana



Ghana Web (2014)

1.2 Healthcare institutions and healthcare situation in Ghana

The World Health Organization (WHO) defined Hospitals as "health care institutions that have an organized medical and other professional staff, and inpatient facilities, and deliver medical, nursing and related services 24 hours per day, 7 days per week" (WHO, 2016). Healthcare institutions in Ghana refer to public and private clinics, primary healthcare, secondary and tertiary/referral hospitals. In Ghana, as in many other developing countries, there are three healthcare systems: the public which is operated through the national health insurance scheme (NHIS); the private health care organizations and non-governmental organizations (NGOs); and traditional healthcare and self-medication (Australian Red Cross and ACCORD, 2009). Access to quality health care is said to be a fundamental human right but the numerous challenges faced by modern health care systems make this a reality for only a section of the Ghanaian populace (ACDEP, 2007).

For a population of 25,758,108 people (Quaicoe-Duho, 2015) there are only 2,615 medical doctors on the Ministry of Health's (MoH) payroll, practicing in 1,818 hospitals (Ghana Hospitals, 2012). Consequently, the doctor to population ratio was 1: 10,170 in 2013 nationally, which falls far below the WHO revised standard of 1:600. In some regions of Ghana the ratio is much worse with only one doctor for every 93,000 potential patients population (Mitchell, 2013).

Nationally, the physical coverage (measured as the proportion of the population living within a defined radius of facilities) of health facilities (public, private) differs, and is lower in the northern part of the country (Ministry of Health, 2007). Averagely, Ghanaians live 16km from a healthcare facility where they can consult a doctor, but half of the population lives within a 5km radius, which relates to a 1-hour walking distance (van den Boom et al. 2004). Struggle in gaining access to hospitals tied with low standard of living have led to an increase in self-medication for which most patients spend the equivalent of $1.50 compared to visiting a private doctor at the cost of $10 (van den Boom et al. 2004).

In Ghana, there are several health problems such as malaria, HIV/AIDS, maternal and infant mortality, which the shortage of health professionals and lack of healthcare interventions have worsened (ITDP Europe 2005).

1.3 Research context and justification

This case is of the views of IT managers of public hospitals in Ghana, health information technology (HIT) project leaders, lecturers in biostatistics/health informatics, national health insurance agency (NHIA), Ministry of Health (MoH), Ghana Health Services GHS), the National Information Technology Agency (NITA), Ghana. The e-health initiatives in these hospitals are interventions to improve the healthcare situation in Ghana (IRIN 5 August, 2008, ITDP Europe, 2005, Mitchell, 2013, van den Boom et al., 2004, WHO, 2011, GBN, 2012). Low-income countries, however, have struggled to implement large-scale e-Health system initiatives with most being project-based (WHO, 2012), which questions when e-Health will become part of the standard care (Heinzelmann et al., 2005). The employment of any information system in an organizational context necessitates appropriate preparation and management for change (Callioni, 2006). e-Health readiness assessment becomes an important prerequisite preceding the adoption of the e-Health system (Demiris et al., 2004, Jennett et al., 2003a). An opportunity therefore exists to find out from participating public healthcare facilities and related organizations the determinants of health information technology (HIT)/e-Health readiness of public healthcare facilities in order to develop a HIT/e-Health[1] readiness assessment model.

The lack of information about healthcare institutions' IT readiness for the implementation of new health IT/S-based systems increases ambiguity for decision makers and decreases their

[1] HIT and e-Health are used interchangeably to mean the same.

ability to make effective choices that would mitigate IT/S innovation risks (Zaltman et al., 1973). This eventually leaves developing countries struggling to initiate large-scale e-Health initiatives that barely survive beyond the project phase (Latifi et al., 2009). As a result, there is a need for a scientific approach to understand what it takes to prepare for a sustainable e-Health adoption in public healthcare institutions. A few studies including Afarikumah (2014), Yusif and Soar (2014), Yaw et al. (2015), Sarfo and Asiedu (2013) have stressed the need for larger scale studies in the area of e-Health readiness among healthcare institutions in Ghana.

The emphasis of this PhD research is on the development of an HIT readiness assessment model for public hospitals in Ghana and in the process to identify the facilitators and barriers of IT readiness among public hospitals in Ghana.

1.5 HIT/e-Health in Ghana

As with many developing countries, the healthcare system in Ghana is faced with many challenges, in particular accessibility and affordability with rural and remote communities impacted the most. There have been recent reforms in the health information management systems aimed at improving the quality of health information. This has largely been in response to requests from donor agents like the United Nations Development Program (UNDP) and also as a commitment to meeting the Millennium Development Goals (MDGs) (Emmanuel, 2012). There is currently a national e-Health strategy launched by the Ghana Government in 2010. A particular challenge for developing countries is ensuring that ICTs are effectively mobilized to improve health outcomes and combat disease among the poorest and most remote populations. As an intervention, a number of conglomerates/or donor organizations in partnership with the Ministry of Health, Ghana have introduced many pilot projects with collective objectives, which include but are not limited to the dissemination and collection of data, education initiatives and telemedicine. Other initiatives are dedicated to promoting e-health and a range of Web-based health consultancy services. Mobile devices in use range from PDAs to simple mobile phones and smart phones. Most of the projects have been donor initiated. They include: Sene PDA, Mobile Teledermatology, Mobile Technology for Community Health (MOTECH), Millennium Villages and Mobile Telemedicine, Moofields/Korle Bu Eye Centre, Ghana Consultation Network, USAID-Deliver Project, Early Warning System-Focus Region Project, mPedigree, e-Health Initiative, Vodafone Healthline Project, and Mahiri Mobile (Afarikumah, 2014).

The national health insurance scheme (NHIS) has introduced electronic identification cards to help minimize fraudulent claims and also for easy identification of NHIS clients at health facilities throughout the country (Emmanuel, 2012). In a very limited context on readiness assessment for implementation of Electronic Patient Records (EPRs) in a university hospital, Adjorlolo and Ellingsen focused on hospital resources and the characteristics of health workers in determining EPR implementation and use (Adjorlolo and Ellingsen, 2013). A study found that the state of ICT infrastructure in Ghana is comparable with other developing countries and that there is the need for the Government of Ghana to make use of ICT to improve the delivery of healthcare so as to reduce poverty (Achampong, 2012). Another e-Health study in Ghana has found that e-Health implementation requires good planning, strong management and physician leadership and supportive staff (Emmanuel, 2012). The findings and recommendations of these studies build a strong case for this research study, which will be focusing on assessing the HIT readiness of public hospitals in the context of e-Health adoption and developing a model, which could be used in other hospitals intending to implement e-Health.

The thesis is organized as follows:

Chapter 2, provides detailed a review of relevant literature in the areas of the technologies of e-Health, background and formulation of definition, selected e-Health systems, e-Health in developing countries, benefits of e-Health, existing e-Health readiness assessment models/frameworks and the main constructs/factors identified/explored. This was followed by gaps being identified and research questions. The key outcome of this chapter was determining gaps in the literature and the formulation of research questions posed.

In chapter 3, a further review and discussion regarding the selection of appropriate theories was conducted. Two important levels of IT adoption theories were discussed: technology acceptance at individual and organizational levels respectively. At individual level, theory of reasoned acceptance (TRA), technology acceptance model (TAM), motivation model (MM) and unified theory of technology acceptance and use theory (UTAUT) were discussed. At the organizational level theories, diffusion of innovation (DOI), technology-organization-environment (TOE), DeLone and McLean information systems (D&M IS) Success Model and Stakeholder theory were critically reviewed for their relevance and applicability to this study. The main outcome of this chapter is the selection and adoption of TOE, D&M IS Success Model and Stakeholder theory as the most appropriate theories for this research study. In answering the formulated research questions in chapter 2, a three-phased research methodology was adopted in chapter 4 – research methodology. This chapter provided information about this research's philosophical stance, pragmatism and justification for the adoption of this philosophy. This was followed by the main research methodology – three-phased research methodology: systematic literature review for the identification of relevant readiness assessment study models; interviews for qualitative data, which served as input for survey instrument development for quantitative data collection for the third phase. The fundamental outcome of this chapter was a comprehensive plan on how to find answers to the formulated research questions for this research study.

Chapter 5 reports on the qualitative data collection in detail. It delineates the protocols followed in the collection of qualitative data. Aspects include justification for one-on-one interview, sampling strategies, recruitment of participants, steps involved in writing in-depth interview guide, conducting the interviews and analyzing the data. The major outcomes of this chapter are the procedures followed and activities undertaken in order to collect credible and valid data.

In chapter 6, a detailed procedure for the analysis of the qualitative data garnered in chapter 5 was determined and the findings reported. Aspects covered include the process of thematic analysis for the identification/generation of themes/concepts towards model development. The basic outcome of this chapter was the themes and concepts that were generated during the thematic analysis.

Chapter 7 discussed the development of a preliminary HIT adoption readiness model using themes generated from the thematic analysis in chapter 6.

Chapter 8 reports in detail on the techniques that were employed towards quantitative data collection. The sections included discussion on how the instrument was designed and managed during the survey for quantitative data collection. The main outcomes of this chapter are the determination of the processes and procedures that were employed for the collection of quantitative data.

Chapter 9 reports on the different methods used to analyze the quantitative data garnered in the preceding chapter, 7. Exploratory factor analysis (EFA) was used in factor extraction and multiple regressions were used to test the hypotheses formulated in this research study. The basic outcome of this chapter is the acceptance or rejection of the hypotheses.

In chapter 10, interpretations of both qualitative and quantitative data are reported.

The conclusion and recommendations chapter, 11, provides information about the contributions made by this research study in information systems (IS), in particular HIT and the limitations of the research. The fundamental outcomes of this chapter are the conclusions and commendations emanating from this study in the context of improving readiness assessment and a possible direction for future research in IS in the healthcare environment.

The following chapter presents the literature review in information technology/system in healthcare.

Chapter 11 sums up the findings in the context of a conclusion and implications of the findings to the research and practice communities. It also delineates the limitations of the study and suggests future potential research.

CHAPTER TWO: LITERATURE REVIEW

Chapter Overview

In Chapter 1 an overview of the situation relating to Ghana in the areas of health care delivery, research context and e-Health were discussed, providing an environment for this study. The research environment disclosed the use of ICT in Ghanaian health and the challenges faced by future deployment of similar systems. Thus, with increasing investment by developing countries in ICT in the health sector in anticipation of providing citizens with quality and accessible healthcare, e-Health seems to provide the solution.

This chapter, however, presents the overall literature in as far as IT adoption in the healthcare environment is concerned in developing countries, with particular emphasis on Ghana. The chapter takes a detailed look at the e-Health background information of and adoption of a subsequent definition for this research. This is because there an array of definitions currently exists – some peculiar to some initiatives/projects and others more generic. There have been efforts by developing countries to adopt IT in the delivery of healthcare due to its potential to improve healthcare accessibility and quality. The question of the ability of developing countries to fully adopt and institutionalize IT remains in the balance as their e-Readiness/e-Health remains uncertain. As a result, this chapter presents existing e-Health readiness assessment models and studies, which will be used to provide a basis for this research.

2.0 Introduction

The rapid development of information and communication technologies (ICTs) has fundamentally altered many aspects of life in societies all around the world (Mardikyan et al., 2015). ICT has become a major tool in the delivery of health services and has had a revolutionary impact on how we live and perceive the world. It has given birth to the contemporary "Es" such as e-learning, e-commerce, e-governance, e-banking, and e-health (Idowu, 2015). As a result many countries have established national initiatives to implement information technologies to improve patient safety and the quality and efficiency of health care services (Rozenblum et al., 2011), and Ghana is no exception (Achampong, 2012, Adjorlolo and Ellingsen, 2013, Afagbedzi et al., 2013, Afarikumah, 2014). In developing countries, the major challenges of implementing national health information technology initiatives lie with the significant gaps evident between national e-Health strategy documents and their actual implementation. While most countries do have policy documents representing e-Health strategies, translating these strategies into reality has never been easy if not outright impractical.

e-Health may be defined as the use of information and communication technology (ICT) – including computers, mobile phones, satellites, software, information systems and digital platforms, etc. – to enable, support and deliver health services to patients and populations (Shekar and Otto, 2014). e-Health can make use of tools like mobile phone-based health (mHealth) applications, telemedicine systems, or eLearning programmes, and includes the digitization of a country's Health Management Information System (HMIS) or Health Information System (HIS), electronic health records (EHR), hospital information systems, district health information systems, telemedicine, patient portals, OpenMRS (Shekar and Otto, 2014, Ruxwana et al., 2010). The services of e-Health actually know no geographic boundaries and not limited by brick and mortar walls, making healthcare services more accessible to ordinary people.

2.1 Information Technology (IT) Adoption in Healthcare

Motivational forces for change are complex but include perceptions of current status in regard to clinical (e.g., assessment and services) as well as organizational (e.g., clinical systems) functioning (Lehman et al., 2002). As a result, the proliferation of HIT in supporting highly specialized tasks and services has made it increasingly important to understand the factors essential to technology adoption (Peeters et al., 2011). The identification and comprehension of these factors serve as a bedrock in diffusing and adopting technological innovations in health.

Health-care systems continue to be under intense pressure to reduce costs, improve quality and at the same time improve the quantity of services (Lamminen et al., 2011). These are big ask in many folds given that no class of economy – advanced or developing – has ever self-claimed sufficiency in its health budget allocation. ICTs are ideally powerful tools to support health systems, with improvements ranging from electronic health records to transmission of clinical data (Schweitzer and Synowiec, 2010). In effect, service subscribers, in particular patients, may be able to access health services right in the comfort of their home environment without having to travel or wait in queues. This is because modern healthcare services are expanding beyond the traditional methods of physical contact with the patients to the virtual platforms of e-Health (Qureshi et al., 2012). A large chunk of the medical data and information are still in paper form and are stored manually (Justice, 2012). This implies that accessibility and sharing of medical information could be a painful transition. e-Health is needed to support healthcare professionals and the workforces of developing countries to increase their efficiency and improve their access to and ability to share health information (Kalema and Kgasi, 2014). They must be able to connect to platforms, which allow them to seek second opinions from their specialists' counterparts on case they are unsure about being able to access current and relevant information as part of their professional development, in order to not get left behind. Three main topics regarding the impacts of e-Health are of interest to Piette et al. (2012). They are: outcomes among patients with chronic health conditions, the cost-effectiveness of various e-Health approaches; and the impact of e-health in low- and middle-income countries. The realization of these outcomes lies in the efficient and reliable implementation of any HIT intervention that offers real value to end users. In a related study Black et al. (2011) thematically categorized e-Health technologies into three main areas: (1) storing, managing, and transmission of data; (2) clinical decision support; and (3) facilitating care from a distance. They found that regardless of support from policymakers, there was comparatively little practical evidence to authenticate several of the claims made in relation to health information technologies.

Medical personnel in developing countries are poorly equipped with limited access to medical data and facilities to share information with their counterparts in urban medical institutions (Qureshi et al., 2012). Even in cases where automation is evident, the available information is still kept in disparate datasets and repositories within diverse formats (Coleman and Coleman, 2013a). Therefore, the realization of any benefit of health information technology or e-Health, covers a multitude of sins. It requires much more than just technology there has to be a need for such technologies first, then the issues of available funds and skills to operate and manage these technologies and above all there need to be willing participants/end users. Likewise quality improvements and waste reduction in hospitals (as in any other organization) require a holistic and profound understanding of the problems (known or unknown), which are a result of the way people work and organize themselves (Dahlgaard et al., 2011). This provides valuable impetus for value proposition and value creation.

The management of organizational culture is increasingly being viewed as a necessary part of health system reforms (Scott et al., 2003). For example, in the United Kingdom, the National Health Service (NHS) reforms were premised on the fact that the organization needed to be secured alongside structural and procedural change to deliver desired improvements in quality and performance (Department of Health, 2000). Similarly in the United States, when faced with the challenge of high profile reports documenting gross medical errors, policy thinking is embracing the notion of cultural change as a key element of health system redesign (Kohn et al., 2000). Also, in the Organization for Economic Cooperation and Development (OECD) countries, there is evidence pointing to a focus on cultural change and renewal as potential levers for health care improvement (Hurst, 2002). Simply put, culture is social behavior of a specific group or society. As a result, the understanding of the culture of healthcare providers, recipients and the entire of healthcare environment workforce will go a long way towards providing clues to decision and policy makers to successfully embark on relevant changes, which include the introduction and use of ICT.

In light of the importance of culture in healthcare organizations, and if politicians and healthcare managers are to be believed, then health systems in many countries stand perennially on the threshold of fundamental cultural change (Scott et al., 2003). This will help provide better information for stakeholders interested in promoting or considering improvement strategies such as the ICTs. It will also help to determine what benefits to expect from health information technology use. More so, as Chaudhry and colleagues found, understanding the culture of healthcare providers will provide information on how best to implement new systems in order to maximize the value derived from their investment, or how to direct policy aimed at improving the quality, quantity and efficiency delivered by the health care sector as a whole (Chaudhry et al., 2006). Tong et al. (2015) also found that organizational culture significantly influences knowledge sharing and job satisfaction. Knowledge sharing plays an important mediating role between organizational culture and job satisfaction. Therefore, physicians and the organizations that support their identified needs must fully understand their roles. Both must advance their awareness of the new consumers and their needs and define specific action items, which will help them realize the benefits of e-health (Ball and Lillis, 2001).

While the potential benefits of e-Health applications could be substantial, healthcare organizations and proponents of e-Health adoption must have exhausted all avenues in terms of finding solutions to their problems before eventually resorting to e-Health. The advent of IT-applications has made many organizations replace their conventional ways of doing things with the IT-based methods and procedures (Qureshi et al., 2015). The adoption of ICT systems by health care providers, however, is some 25 to 30 years behind many other private and public industries (Smadu, 2007). As a result there is an understandable sense of urgency with which these e-Health initiatives are now being commissioned, developed, and deployed, typically at considerable expense (Brantley et al., 2004, Iakovidis, 2008). Experience has continually shown that if attempts are made to implement poorly designed systems, there is a real danger that not only will the expected benefits fail to be realized (Iakovidis, 2008, Stead and Lin, 2009, Rodrigues, 2008) but also that vast sums of money would have been squandered in the process. Worse still, patients' safety may also be compromised (Ammenwerth and Shaw, 2005, Mudur, 2004). For example, in order to reduce concerns that health systems encountered, EHRs are supposed to prevent duplicated prescriptions and hospitalizations, ineffective transferability of medical records, lack of communication in clinical assessments, etc. Recent debates, however, have shown that EHR presents pros and cons (technical, financial, social) that governments need to clarify urgently (Laur, 2014). These clarifications are a much more deep-seated problem than actually perceived especially the social aspect, which is quite difficult to determine.

2.2 Background and adoption of e-Health definition

The history of e-health as health informatics goes back a couple of decades, to the development of the first automated pathology reporting applications installed in the first DOS-based non-mainframe computers (Curtis, 2007). The first recorded instance of the use of telemedicine in Australia occurred in 1917, when Postmaster Tuckett, in Halls Creek, Western Australia, performed surgery on a stockman with serious internal injuries after falling from his horse by following instructions telegraphed in Morse code to him by surgeon JJ Holland in Perth (Health on Line, 1997).

During the 1990s, as the Internet exploded into public consciousness, a number of e-terms began to appear and proliferate (Oh et al., 2005). The proliferation of the e-terms mainly took place in almost all industries, except health. This is understandable given that many industries, which are currently enjoying competitive advantage on the back of these e-terms also suffered numerous crushes. Health, unlike many other industries may have crushed many lives. Having evolved from the terms Telemedicine and Telehealth, the term "e-Health", can now be found in around 4,000,000 Web pages (ITU, 2008). Telemedicine is the use of ICT to transfer medical information for diagnoses, therapy, and education at a distance (Norris, 2002). Telehealth on the other hand includes surveillance, health promotion and public health functions. It is broader in definition than telemedicine as it includes computer-assisted telecommunications to support management, surveillance, literature and access to medical knowledge (WHO, 2013). The scope of e-Health is health in general, with its two major facets, namely public health and healthcare, which is geared towards individual patients and the treatment of disease (ITU, 2008). In a systematic review of peer reviewed literature, Oh et al. (2005) found that there were 51 definitions of e-Health. A WHO definition included some commercial terms such as e-Commerce. All the definitions however, explicitly or implicitly made mention of the terms “health” and “technology”. In all of these definitions there were elements of potential of e-Health to solve the growing pressure on health care systems and health care delivery in terms of cost, quality, time and improved health care management in the aspect of portability and access to health care (Oh et al., 2005).

In their review of the definitions of “e-Health” Oh et al. (2005) found that the most used definitions in terms of frequent citing are Eysenbach’s (2001) and Mitchell’s (1999) respectively. Eysenbach defined e-Health as “an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies” (Eysenbach, 2001). In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking to improve health care locally, regionally, and worldwide by using information and communication technology (Eysenbach, 2001). “e-health is a new term used to describe the combined use of electronic communication and information technology in the health sector, OR is the use, in the health sector, of digital data-transmitted, stored and retrieved electronically for clinical, educational and administrative purposes, both at the local site and at a distance” (Mitchell, 1999). It can be established that there is no one universally adopted definition of the term “e-Health” from the literature reviewed above. The aim of this section is to adopt a definition for the purpose of this study. Many researchers have attributed the low adoption rate of e-Health in many countries (especially in developing countries) to the issue of acceptance by healthcare professionals and non-healthcare professionals, with some citing factors such as security, uncertainty, trust, and lack of computer literacy as reasons (Scott, 2015, Sun and Rau, 2015, Yeo, 2015, Bayer et al., 2015). This encompasses the state of mind, thinking methodology and attitudes of stakeholders towards e-Health, which Eysenbach further elaborated on as part of his definition explanation.

Applications in the area of e-health include data management systems to store patient data, computerized learning tools for health training or diagnosis and treatment at distance (ibid). Most definitions of e-health have focused either on consumers and providers, organizations or all, e.g. (Broderick and Smaltz, 2003, Chisholm, 2003, Coile Jr, 1999, Della Mea, 2001, Deluca and Enmark, 2000, Ellis and Schonfeld, 2000, Eng, 2001, Gustafson and Wyatt, 2004). As a result, a holistic definition is required. For that matter, in this study HIT/e-Health is defined as the delivery and management of health information for and by healthcare providers, receivers and policy makers through the internet and telecommunications using computers and mobile phones with the hope of increasing and improving healthcare access and services respectively. The future of e-Health will depend on human factors, as well as economics and technology (Heinzelmann et al., 2005). There have been insufficient studies up to this point in time on positive clinical impacts, cost-effectiveness, improved process, efficient use of staff time, and safety (Ackerman, 2010).

2.3 Electronic health record (EHR)

EHR implementations are widespread because of their potential to enhance health care delivery (Achampong, 2012). But e-Health systems in general have been well recognized as costly investments (Nguyen et al., 2014). They have been known for complexity and uncertain clinical benefit (Harle et al., 2016) managing workflow, selecting data to migrate, and hiring extra staff for data entry (Felt-Lisk et al., 2009, Harle et al., 2016). As a result meaningful use of EHRs is an important migration consideration (Dolezel and Moczygemba, 2015). An electronic health record (EHR) is a systematic electronic collection of health information about patients such as medical history, medication orders, vital signs, laboratory results, radiology reports, and physician and nurse notes (Campanella et al., 2015). The electronic health record (EHR) is viewed as the backbone supporting the integration of various information tools (Gagnon et al., 2014). The scope of many large EHR implementations includes not only inpatient and ambulatory clinical applications, but also revenue cycle and clinical data applications (Bell and Thornton, 2011). An EHR is a comprehensive health record and include features such as interoperability[2], decision support[3] and continuity of care[4]. Through these features EHRs can provide increased communication, coordination, and decision support (Ginsberg, 2007).

Facilitators and barriers to EHR adoption such as cost, physician resistance and organizational characteristics have been identified by numerous studies, see e.g. (Ash and Bates, 2005, Blumenthal et al., 2006, DesRoches et al., 2008, Furukawa et al., 2008, Poon et al., 2004).

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[2] The ability to exchange information with other sources – for example, to order laboratory tests and integrate results directly into the record, GINSBERG, D. 2007. Successful Preparation and Implementation of an Electronic Health Records System. *Best Practices: A guide for improving the efficiency and quality of your practice*.

[3] The ability to use information about a patient within the EHR in combination with external information to guide the physician in patient care, ibid.

[4] The ability to exchange and interface patient clinical data with other health care providers such hospital emergency departments or specialists and providers with their own personal health record, ibid.

2.3.1 Benefits of EHR

One of the principal benefits of EHR is the increased quality of care resulting from patients having their essential health data accessible to different providers, which can significantly improve the coordination of care (Intentions, 2006, Staroselsky et al., 2006).

Empirical studies/literature supports several benefits of EHR for patients (Blumenthal, 2010, Buntin et al., 2011, Hollingworth et al., 2007, Holroyd-Leduc et al., 2011, Shachak et al., 2009, Shekelle et al., 2006, Simon et al., 2007). Notable among them are:

- EHRs have the ability to capture structured data as a means to assess the quality of patient care and provide a base for trend analysis. Medicare supports and recognizes the benefits of EHRs in providing quality care and improving outcomes.
- Access to clinical information across the continuum of care to support provider decision making
- Real-time clinical decision-support prompts and alerts to physicians, which directly leads to better patient care and a reduction in medical errors
- Increased medication safety and fewer adverse drug events
- Standardization of care to improve patient outcomes, notably through the use of standard order sets, based on evidence-based medicine, for major medical conditions
- Better preventive care through improved communications between physician and patient as well as proactive patient reminders
- Empower citizens to actively take part in decisions regarding their health, and could be used to track the delivery of recommended preventive care across primary care practices (De Leon and Shih, 2011).
- Computerized physician order entry (CPOE), as a core component of EHR has been proven to decrease delays in order completion, reduce errors related to handwriting or transcription, provide error checking for duplicate or incorrect doses/tests, and simplify inventory and posting of charges (Bell and Thornton, 2011, Ginsberg, 2007).
- Many of the positive outcomes identified above also have a positive impact on a hospital's fiscal bottom line, in the form of cost reductions, cost avoidance, top-line revenue growth, and cash-flow increases (Bell and Thornton, 2011). For example, using measurement of key financial indicators in a study of five ambulatory offices with a total of 28 providers Grieger et al. (2007) observed a total annual saving of $393,662 ($14,055 per provider), a demonstration of positive return on investment.

- EHRs can be used to track the delivery of recommended preventive care across small primary care practices serving lower income communities in which little data is generally available for assessing population health (Tang et al., 2007, Weber et al., 2008, Persell et al., 2009, De Leon and Shih, 2011)

2.3.2 Opportunity cost of not adopting e-Health

Healthcare institutions, which have not adopted e-Health could be missing out on the above-mentioned potential benefits. A study by Fortescue et al. examined 10,778 medication orders and characterized 616 of those orders containing errors occurring in the paediatric inpatient units of two academic tertiary referral medical centres (Fortescue et al., 2003). One hundred and twenty (19.5%) were flagged as potentially harmful. The report also found that 74% of the errors occurred at the ordering stage; and 28% in dosing. Promising e-Health systems which could have disallowed most possibly harmful errors include: 1) computerized physician order entry with clinical decision support systems; 2) ward-based clinical pharmacists; and 3) improved communication among physicians, nurses, and pharmacists. Duplication of medical testing results is a financial burden to the healthcare system (Stewart et al., 2010). Furthermore, a study by Mullet and colleagues reported a 59% decrease in pharmacist interventions for erroneous drug doses and a decreased number of patient days of sub-therapeutic or excessive anti-infective doses (Mullett et al., 2001).

2.4 HIT/e-Health projects in developing countries

There is a severe shortage of healthcare provision in Africa. Hence the tendency for e-Health projects to grow in number in some African countries over time, in particular, countries with larger gross national incomes (GNIs) (Jahangirian and Taylor, 2013) to help improve health care delivery (Ackerman, 2010). While it is understandable for the increase in e-Health initiatives to serve as various mitigation strategies in the bid to improving healthcare delivery, the challenge, however, will be the ability to overcome duplication/redundancy in order to cut down waste to make way for visible and shared objectives due to the risk of lack of expertise in the field of e-Health implementation across developing countries.

From OpenMRS in Botswana, Ethiopia, Gabon, Ghana, S. Africa, Lesotho, Mali, Zanzibar, Nigeria, Rwanda, Congo, Senegal, Sierra Leone, Malawi, Gambia, Kenya, Zimbabwe, Mozambique, Uganda, Tanzania (Seebregts et al., 2009) to Episurveyor project in Uganda, Benin, Cameroon, the Democratic Republic of Congo, Ethiopia, Ghana, Madagascar, Rwanda, Senegal, Kenya and Zambia (Richards, 2009) (See appendix 2 for details), HIT initiatives have been on the rise. Many of them focus on telemedicine, health education and health-related research with a wide range of funding bodies, some of which have a geographical focus (Jahangirian and Taylor, 2013). There is a need for state governments in resource-constrained countries to begin determining sustainable state funded projects to enable the pursuance of locally identified needs for HIT services.

e-Health offers great promise in low and middle-income countries (LMICs) whose health systems face severe financial, infrastructural, technical and human resource constraints (Schweitzer and Synowiec, 2010). The development of telecommunications and computer technology since the 1960s Space Age has implications for the improvement of the quality of health care for those who live in remote or isolated areas where access to quality health care has traditionally been a problem (Zundel, 1996).

Many articles speak of the "potential" of e-Health, particularly for providing access to care for individuals in rural and remote places. This potential must be converted into reality for the developing world, particularly Africa where the struggle with inhumane circumstances is more evident (Scott and Mars, 2015). The continent of Africa is home to 14% of the World's population. However, it continues to struggle with 24% of the global burden of disease (GBD), and yet is served by just 3% of the world's health workers with access to merely 1% of world health expenditure (World Health Organization, 2006ß). Therefore, adopting platforms, which enable access to a pool of healthcare professionals globally to give a helping hand whenever possible in the unified goal of providing unlimited access to affordable and quality healthcare would have been seen to be the most important use of IS/IT.

Designing e-Health strategies to address these immediate needs must be scalable, sustainable and focus on the efficient and accurate capture and transmission of clinical information (Mamlin and Biondich, 2005). Within clinical care settings, just-in-time patient data facilitates the care process, and alerts or reminders enhance the quality of care (Dexter et al., 2001, Biondich et al., 2003) and contribute towards increased access to healthcare. The accurately captured data can facilitate public health epidemiological efforts and fuel both prospective and retrospective research projects (Mamlin and Biondich, 2005).

Evidence from the limited set of pilot projects has demonstrated both the promise and challenges of implementing e-Health on a large scale (Ibrahim, 2009). Many challenges affect e-healthcare adoption in developing countries as part of routine health care delivery (Omary et al., 2010). Differing among countries, other challenges include a lack of a patient unique identifier, sustainable funding, availability of qualified health professionals, a low rate of Internet penetration and low bandwidth, lack of healthcare policies, lack of acceptable global standards and privacy, confidentiality and security concerns. In developing countries, where there is comparatively less existing technical infrastructure and fewer e-Health systems installed in hospitals, the focus will be on basic health data collection, basic ICT infrastructure such as connectivity, and healthcare access (Foh, 2012). Perhaps the most difficult question to answer, however, is "*when will [e-Health] become part of the standard of care*" (Heinzelmann et al., 2005)? The future of [e-Health] will depend on: (1) human factors, as well as (2) economics and (3) technology (Heinzelmann et al., 2005). Table 2.1 presents the challenges for the future of e-Health

Table 2.1: Challenges for the future of e-Health

Factor		Challenges
Human Factors	Individuals	• Address concerns about training, liability, patient security and increased workload among providers
	Organizations	• Demonstrate the value of e-Health to the health payer, provider and advocacy organizations • Align e-Health with the increasing emphasis on self-care and multidisciplinary care models • Continue clinical trials at academic institutions to demonstrate that e-Health solutions are effective and efficient
	Society	• Promote acceptance of a patient-centered and technology-enabled method of health-care delivery, create practice environments that reduce defensive medicine practices, which in turn limit the adoption of new clinical interventions such as e-Health (e.g. malpractice reform) • Create a compelling case for lifting licensure restrictions that inhibit e-Health activities across borders
Economics		• Pilot new third-party reimbursement mechanisms to attract greater patient and provider participation, particularly in health systems that are not supported publicly • Explore global markets for e-Health solutions that allow the

	export of medical expertise • Seek sustainable economic models that support e-Health solutions in the developing world to address the growing burden of chronic disease
Technology	• Improve usability for patients with limited function, who aim to benefit from e-Health solutions • Implement methods that verify authorized access to health information such as fingerprint and voice recognition • Create communications devices that are smaller, less expensive and more powerful, which will be available at the point of care • Create sensors that are more sensitive, less expensive, passive and less obstructive • Introduce methods of bridging the 'digital divide' faced by developing countries

Source: Adapted from Heinzelmann et al. (2005).

2.5 e-Readiness

Electronic readiness (e-Readiness) is a measure of the degree to which a country or an economy may be ready, willing or prepared to obtain benefits which arise from the use of information and communication technologies (ICTs) (Dada, 2006). In e-readiness measures countries are ranked in areas such as the number of telephone lines per every 100 people or the percentage of GDP spent on IT infrastructure. "Readiness of the Networked World" is a Harvard University research project, which sets out a framework for developing countries to evaluate their e-readiness. In the context of Harvard University's e-readiness evaluative tool for developing countries, CID (2006) also defined e-readiness as "the degree to which a community is prepared to participate in the Networked World, which is gauged by assessing a community's relative advancement in the areas that are most critical for ICT adoption and the most important applications of ICTs". The Economist Intelligence Unit also defines a country's e-readiness as a "measure of its e-business environment, a collection of factors that indicate how amenable a market is to Internet-based opportunities" (Unit Economist Intelligence, 2008). For instance in Ghana, the development of the ICT4AD policy, and provision of an supporting environment have backed massive ICT infrastructure investments and renewed availability of broadband for national development (ITU et al., 2012). The Economist Intelligence Unit's rankings are commonly used for measuring e-readiness.

2.6 e-Health readiness assessment models/frameworks – Systematic review

There are many e-readiness assessment models/frameworks that are used in the healthcare sector today and many of them assess a specific dimension in the healthcare environment (Coleman and Coleman, 2013a) and employ different methodologies. This makes it difficult to determine or reach some standard frameworks, which may be used as guidelines for assessing a country's HIT readiness. e-Health readiness refers to the preparedness of healthcare institutions or communities for the anticipated change brought about by programs related to ICT (Khoja et al., 2007b).

In assessing the readiness of e-Health systems, some dimensions were assessed in empirical studies: organizational and healthcare workers readiness (Adjorlolo and Ellingsen, 2013, Acquah-Swanzy, 2015) motivational, engagement, technological, societal, and technological (Biruk et al., 2014, Chipps and Mars, 2012, Coleman and Coleman, 2013b, Coleman et al., 2012, Durrani et al., 2012, Jennett et al., 2003b, Jennett et al., 2005b, Justice, 2012, Khatun et al., 2015, Khoja et al., 2007b, KHOJA et al., 2008a, Leon et al., 2012, Li et al., 2012a, Mucheneh, 2014, Nahm et al., 2008, Oio et al., 2007, Qureshi, 2014a, Scharwz et al., 2014, Simon et al., 2008, Snyder-Halpern, 2001a, Tamburis et al., 2012, Touré et al., 2012). In some readiness assessment studies "Need-change" was preferred to "Motivation" (Coleman and Coleman, 2013b, Oio et al., 2007, Paré et al., 2011). A few others (Justice, 2012, Durrani et al., 2012, Biruk et al., 2014, Chipps and Mars, 2012, Jennett et al., 2003b, Khoja et al., 2007b, Khoja et al., 2008b, Scharwz et al., 2014, Simon et al., 2008) would rather use core readiness in place of motivation and need-change readiness. Other readiness factors including clinical component, demonstration of community commitment and leadership, matching funds, overall technical preparedness, plans for a sustainable business model, use of data standards, and use of replicable and scalable tools were assessed as readiness factors by Overhage et al. (2005) to establish whether communities were interested in creating Local or Regional Health Information Infrastructures (LHII) and were developing the requisite leadership commitment to translate that interest into operational realities.

Snyder-Halpern (2001c) used a two-round expert panel (Delphi) approach to successfully validate a seven IT/S innovation readiness sub-dimensions of an organizational information technology/systems innovation model (OITIM) previously developed (Chipps and Mars, 2012, Khoja et al., 2007b). While acceptance and use (Oio et al., 2007, Lua and Ibrahim, 2015, Duplaga, 2015, Qureshi, 2014a, Nahm et al., 2008, Jafari et al., 2015), of IT skills (Mucheneh, 2014, Mirkarimi and Behnampour, 2014) were assessed as readiness components on the part of care providers and receivers, a study by Wickramasinghe et al. (2005) stressed that Information communication technology (ICT) architecture/infrastructure; Standardisation policies, protocols and procedures; User access and accessibility policies and infrastructure; and Governmental regulation and control were prerequisites for e-Health. Government stewardship and financial systems (Leon et al., 2012), efficacy, practice context, apprehension, time and ownership (Campbell et al., 2001) are a few other dimensions that were used. Of these studies nine (9) studies were conducted in Africa; 5 of which were conducted in South Africa (Chipps and Mars, 2012, Coleman and Coleman, 2013a, Coleman et al., 2012, Kgasi and Kalema, 2014, Oio et al., 2007); 1 in Ghana (Adjorlolo and Ellingsen, 2013), 1 in Nigeria (Justice, 2012), 1 in Kenya (Mucheneh, 2014) and 1 in Botswana (Mauco, 2014). See Tables 2.2 and 2.3 for results.

2.7 Search results and description of included articles

A total of 2916 articles were found, of which 712 papers were duplicates. The selection process excluded the repeated articles from the search and produced a list of 2214 articles. Within the 2214 articles post removal of duplications, 1892 were also excluded because there were not dealing with HIT/e-Health readiness assessment. However, they were IS/T related papers. 65 articles were included, 44 empirical and seventeen reviewed, published between 1995 and 2015, however, two papers (assessing the readiness of Green IT (Molla et al., 2008) and an editorial paper (James and Walsh, 2011)) were later rejected. Refer to Fig. 1 below for article selection process. One paper (Keramati et al., 2011) focused on assessing the e- Learning readiness of nurses, while 7 others (Leon et al., 2012, Martin, 2012, Marshall et al., 2013, Khatun et al., 2015, Lua and Ibrahim, 2015, Okazaki et al., 2013, Tariq and Akter, 2011)focused on assessing mHealth readiness and one (Mirkarimi and Behnampour, 2014) in laboratory environment.

In the context of methodologies used, surveys and secondary data (literature review) were more popular among many studies. General to most qualitative studies, semi-structured interviews were used compared with focus group. In a related setting, survey instruments were mostly used in the quantitative studies. A few of the quantitative studies also used cross-sectional approach in collecting data. Overall, sample sizes were also small, in the range of 80-150 for quantitative studies. Two used interpretative case study (Adjorlolo and Ellingsen, 2013) and (Coleman et al., 2012). Another two, (Snyder-Halpern, 2001b) and (Rezai-Rad et al., 2012a) used expert panel (Delphi approach). See table 2.2 below for detail

Table 1.2: Summary of research methods used in included papers

Study	Method/methodology
(Okazaki et al., 2013, Jafari et al., 2015, Chipps and Mars, 2012, Duplaga, 2015, Kgasi and Kalema, 2014, Keramati et al., 2011, Overhage et al., 2005, Touré et al., 2012, Jones, 2013, Scott et al., 2005, Simon et al., 2008, Tamburis et al., 2012, Parker and Demiris, 2004, Snyder-Halpern, 2001a, Nahm et al., 2008, Biruk et al., 2014, Habibi-Koolaee et al., 2015, Lua and Ibrahim, 2015, Mirkarimi and Behnampour, 2014, Paré et al., 2011, Mauco, 2014)	Questionnaire survey
(DeGaetano and Shore, 2015, Li et al., 2010, Yusif and Soar, 2014, Marshall et al., 2013, Mauco et al., 2016, Tariq and Akter, 2011, Ajami et al., 2011, Blackman et al., 2013, Weiner, 2009, Qureshi et al., 2012, Choi and Ruona, 2011, Li et al., 2012a, Van Dyk, 2014, Wickramasinghe et al., 2005, Backer, 1995, Légaré et al., 2010, Qureshi, 2014b, Qureshi, 2014a, Qureshi et al., 2014)	Literature review
(Amatayakul, 2005, Martin, 2012)	Perspective
(Coleman and Coleman, 2013b, Oio et al., 2007, Li et al., 2012b, Li et al., 2013a, Jennett et al., 2003c, Pabst, 2012, Jennett et al., 2003b, Scharwz et al., 2014, Campbell et al., 2001, Coleman et al., 2012)	Qualitative
(Justice, 2012, Mucheneh, 2014, Leon and Schneider, 2012, Khatun et al., 2015, Strauss et al., 2015, Durrani et al., 2012, Khoja et al., 2008b, Gholamhosseini and Ayatollahi, 2017, Khoja et al., 2007b)	Mixed

Source: Developed for this study

Table 2.3: Summary of factors used in assessing HIT/e-Health readiness

Readiness assessment factor	Source
Organizational/Institutional readiness	(Overhage et al., 2005, Adjorlolo and Ellingsen, 2013, Paré et al., 2011, Mucheneh, 2014, Jennett et al., 2003c, Touré et al., 2012, Qureshi et al., 2014, Ajami et al., 2011, Amatayakul, 2005, Blackman et al., 2013, Leon et al., 2012, Pabst, 2012, Weiner, 2009, DeGaetano and Shore, 2015, Qureshi, 2014a, Qureshi et al., 2012, Choi and Ruona, 2011, Snyder-Halpern, 2001b, Légaré et al., 2010, Leon and Schneider, 2012)
Acceptance and use	(Qureshi, 2014a, Oio et al., 2007, Nahm et al., 2008, Lua and Ibrahim, 2015, Jones, 2013, Duplaga, 2015, Légaré et al., 2010, DeGaetano and Shore, 2015, Jafari et al., 2015, Amatayakul, 2005, Habibi-Koolaee et al., 2015, Scott et al., 2005, Strauss et al., 2015, Tariq and Akter, 2011, Touré et al., 2012, Qureshi et al., 2012, Okazaki et al., 2013, Justice, 2012, Kgasi and Kalema, 2014)
Engagement	(Chipps and Mars, 2012, Kgasi and Kalema, 2014, Biruk et al., 2014, Li et al., 2013a, Overhage et al., 2005, Jennett et al., 2003b, Scharwz et al., 2014, Li et al., 2010, Amatayakul, 2005, Martin, 2012, Keramati et al., 2011, Li et al., 2012b, Justice, 2012, Oio et al., 2007, Rezai-Rad et al., 2012a, Qureshi et al., 2012)
Structural	(Justice, 2012, Jennett et al., 2003b)
Need assessment/Need-change/Core/Motivational	(Durrani et al., 2012, Jennett et al., 2003b, Biruk et al., 2014, Scharwz et al., 2014, Paré et al., 2011, Khatun et al., 2015, Simon et al., 2008, Justice, 2012, Li et al., 2010, Li et al., 2012b, Scott et al., 2005, Strauss et al., 2015, Marshall et al., 2013, Van Dyk, 2014, Li et al., 2013a, Khoja et al., 2007b, Nahm et al., 2008, Oio et al., 2007, Légaré et al., 2010, Coleman and Coleman, 2013b, Li et al., 2012a, Chipps and Mars, 2012, Rezai-Rad et al., 2012a)
Non-readiness	(Jennett et al., 2003b, Coleman and Coleman, 2013b)
Technology	(Tamburis et al., 2012, Touré et al., 2012, Simon et al., 2008, Overhage et al., 2005, Qureshi et al., 2014, Légaré et al., 2010, Li et al., 2010, Chipps and Mars, 2012, Li et al., 2012b, Amatayakul, 2005, Leon et al., 2012, Wickramasinghe et al., 2005, Parker and Demiris, 2004, Mauco, 2014, Scharwz et al., 2014, Yusif and Soar, 2014, Campbell et al., 2001, Van Dyk, 2014, Khoja et al., 2007b, Qureshi, 2014a, Snyder-Halpern, 2001b, Leon and Schneider, 2012, Li et al., 2012a, Rezai-Rad et al., 2012a, Durrani et al., 2012, Qureshi et al., 2012, Khatun et al., 2015, Coleman et al., 2012, Coleman and Coleman, 2013b, Li et al., 2013a)
Societal	(Li et al., 2013a, Khoja et al., 2008b, Qureshi et al., 2012, Qureshi et al., 2014, Kgasi and Kalema, 2014,

	Coleman and Coleman, 2013b, Van Dyk, 2014, Khoja et al., 2007b, Rezai-Rad et al., 2012a)
Policy	(Durrani et al., 2012, Li et al., 2012b, Wickramasinghe et al., 2005, Chipps and Mars, 2012, Van Dyk, 2014, Khoja et al., 2007b, Qureshi et al., 2012)
Demographic characteristics	(Mucheneh, 2014, Khatun et al., 2015)
IT skills/Learning	(Durrani et al., 2012, Qureshi et al., 2012, Mirkarimi and Behnampour, 2014, Simon et al., 2008, Habibi-Koolaee et al., 2015, Keramati et al., 2011, Khatun et al., 2015, Van Dyk, 2014, Khoja et al., 2007b, Mucheneh, 2014, Snyder-Halpern, 2001b, Snyder-Halpern, 2001a)
Aptitudinal	(Mauco, 2014)
Attitudinal	(Mauco, 2014, Mirkarimi and Behnampour, 2014)
Resource	(Qureshi, 2014a, Khatun et al., 2015, Qureshi et al., 2014, Leon et al., 2012, Snyder-Halpern, 2001a, Snyder-Halpern, 2001b, Leon and Schneider, 2012)
Clinical value	(Okazaki et al., 2013)
Time-place flexibility	(Okazaki et al., 2013)
Socio-cultural	(Qureshi et al., 2014)
Psychological & behavioural	(Qureshi et al., 2014, Backer, 1995)
Stewardship	(Leon et al., 2012, Mauco et al., 2016, Leon and Schneider, 2012)
Community	(Pabst, 2012, Overhage et al., 2005)
Socio technical	(Tariq and Akter, 2011)
User access and policy accessibility and infrastructure	(Wickramasinghe et al., 2005)
Socio-economic and development	(Yusif and Soar, 2014)

Environmental	(Snyder-Halpern, 2001b, Gholamhosseini and Ayatollahi, 2017)
e-Health	(Gholamhosseini and Ayatollahi, 2017)
ICT functions	(Gholamhosseini and Ayatollahi, 2017)
Human resource	(Gholamhosseini and Ayatollahi, 2017)
Knowledge	(Snyder-Halpern, 2001a, Snyder-Halpern, 2001b)
Process	(Snyder-Halpern, 2001a, Snyder-Halpern, 2001b)
Value and Goals	(Snyder-Halpern, 2001a, Snyder-Halpern, 2001b)
Management structure	(Snyder-Halpern, 2001a, Snyder-Halpern, 2001b)
Administrative support	(Snyder-Halpern, 2001a, Snyder-Halpern, 2001b)

Source: Developed for this study

Table 2.4: Summary of tools used in measuring HIT/e-Health readiness assessment factors

Assessment factor	Measures	Author
Core	Identifying need assessment	(Li et al., 2010, Scharwz et al., 2014, Chipps and Mars, 2012, Kgasi and Kalema, 2014, Khoja et al., 2007b)
	Assessing dissatisfaction with the status quo	(Chipps and Mars, 2012, Kgasi and Kalema, 2014, Coleman et al., 2012, Justice, 2012, Scharwz et al., 2014, Khoja et al., 2007b)
	Increasing awareness	(Kgasi and Kalema, 2014, Chipps and Mars, 2012, Scharwz et al., 2014, Khoja et al., 2007b)
	Comfort	(Chipps and Mars, 2012, Kgasi and Kalema, 2014, Khoja et al., 2007b)
	Trust with e-Health technology	(Chipps and Mars, 2012, Kgasi and Kalema, 2014, Khoja et al., 2007b)
	Strengthening the process of planning	(Kgasi and Kalema, 2014, Chipps and Mars, 2012, Khoja et al., 2007b)
	Increasing staff satisfaction and willingness	(Khoja et al., 2007b, Kgasi and Kalema, 2014, Chipps and Mars, 2012, Rezai-Rad et al., 2012a)
	Integrating technology with regular services	(Kgasi and Kalema, 2014, Chipps and Mars, 2012, Khoja et al., 2007b)
	Different difficulties respondents face in their current working practice	(Biruk et al., 2014)
	Recognition of unaddressed needs	(Justice, 2012)
	Awareness of current e-health government	(Scharwz et al., 2014)
	Executive Champions for IT/S Projects Integration of Organizational and IT/S strategies	(Snyder-Halpern, 2001a)
Motivation	Poor sharing of patient health records	(Li et al., 2010, Li et al., 2013a)
	Inappropriate prescriptions Physicians' concern about high investment and low reimbursement	(Li et al., 2010, Li et al., 2013a)

Lack of assistance to answering patients’ questions	(Li et al., 2010)
Capturing Alerts Issued by Public Health Units	(Li et al., 2012b)
Appropriateness of Prescriptions	
Correctness of Diagnoses	
Documentation Efficiency	
Completeness and Accuracy of Patient Health Records	
Patient Privacy and Information Security	
Physicians’ concern about high investment and low Reimbursement	(Li et al., 2013a)
Information on the benefits that e-health provides.	(Kgasi and Kalema, 2014)
Financial benefits	
Resistance to change	
Learnability	

	Champions Availability of risk-takers, pioneers Education /awareness process for innovators Reduction of nay-sayers /resisters Ability /willingness of senior administration to consider benefits outside standard business case /cost Effectiveness schemes Willingness to consider long timelines for implementation Movement from short-term funding; short-term accountability deadlines Cost-benefit analysis Established mechanisms of knowledge transfer between staff	(Justice, 2012)
	Perceived usefulness of mHealth services Trust Attitudes/Intentions towards future	(Khatun et al., 2015)
Engagement	Potential negative impacts Recognition of benefits Willingness to accept e-Health training	(Li et al., 2010)
	Information on the benefits that e-health provides. Financial benefits Resistance to change	(Kgasi and Kalema, 2014)

Learnability	
Champions Availability of risk-takers, pioneers	(Justice, 2012, Scharwz et al., 2014)
education /awareness process for innovators Reduction of nay-sayers /resisters Ability /willingness of senior administration to consider benefits outside standard business case /cost Effectiveness schemes Willingness to consider long timelines for implementation Movement from short-term funding; short-term accountability deadlines Cost-benefit analysis Established mechanisms of knowledge transfer between staff	(Justice, 2012)
Clinicians' Concern About Reliability of IT Clinicians' Concern About IT' Impact on Professional Autonomy	(Li et al., 2012b, Li et al., 2013a)
Fear or concern about the potentially negative impacts Recognition of the benefits of e-Health, Willingness to accept e-Health training	(Biruk et al., 2014, Jennett et al., 2003b)
Recognition of benefits	(Rezai-Rad et al., 2012a)

ew chapter

	Potentially negative impacts e-Health education Strategies Legal and financial support of ICT	
	Organizational buy-in for telehealth. Awareness of organizational dynamics between innovators and resistors The commitment and support of senior administrators Accessibility to sufficient ongoing funding from local, provincial and federal institutions Establishment of collaborative partnerships. Methods for telehealth communication, profiling and awareness and are actively involved in promoting these Have cases/proof of telehealth applications in similar contexts. Exhibit healthy inter-organizational dynamics in telehealth promotion activities Willingness to consider short-, medium and long-term timelines for implementation Have established mechanisms of knowledge transfer among staff members. Participate in a community consultation process. Conduct ongoing needs assessments and analysis. Strategic business plan for adopting new e-health technology	(Scharwz et al., 2014)
Technology	Hardware	(Li et al., 2010, Rezai-Rad et al., 2012a)

e-Health related software Network IT support personnel Healthcare providers' past IT experience	
Speed and quality of ICT/Internet at the institution Hardware and software Availability and affordability of the desired ICT Institutional access to ICT/Internet training:	(Chipps and Mars, 2012, Khoja et al., 2007b)
Clinicians' Dissatisfaction with the Software in Use Inefficient IT Support Perceived by Clinicians	(Li et al., 2012b)
Ease of use – capable of using mobile phone Access – accessibility, availability	(Khatun et al., 2015)
IT/S Infrastructure and Performance	(Snyder-Halpern, 2001a)
Establishment of interoperability of equipment and technology Consistent approach to verification of the fidelity of data transmission. Validate how the technology actually works. Accessibility to comprehensive technical support that is available locally and on-call.	(Scharwz et al., 2014)
Employees' access to the telephone Employees' access to email Hospital's access to the intranet (for internal communications) Hospital's access to the extranet (for communication with other agencies) Company's access to the Internet Hospital's rate of investment in ICT	

Societal	Communication links with other institutions Provision of care in collaboration with other healthcare organizations Internal communication among healthcare providers	(Li et al., 2010)
	Collaboration with other health institutions Sharing of locally relevant content between healthcare institutions Consider socio-cultural factors among staff (e.g. Socio-economic position; cultural factors; social roles & circumstances)	(Kgasi and Kalema, 2014)
	Organizational communication links to hospitals, administrative centers Provision of healthcare in collaboration with various healthcare organizations. Sharing of locally relevant content among the practicing community	(Rezai-Rad et al., 2012a)
	Communication links of healthcare organizations with other institutions Provision of care in collaboration with other healthcare organizations Internal communication among healthcare providers adaptation of ICT use to dominant social values General trust of users (personnel and citizens) in implementing ICT Access to ICT Use of networking Socioeconomic status among clients	(Rezai-Rad et al., 2012a)
	Communication with other hospitals Sharing of locally relevant content between hospitals	(Chipps and Mars, 2012, Khoja et al., 2007b)

	Providing care to patients in collaboration with other healthcare institutions	
	Considering socio-cultural factors among staff	
	Considering socio-cultural factors among clients and communities	
Structural	Identification of equipment difficulties; 'bugs'	(Justice, 2012)
	well-conducted needs assessment community ownership	
	allowance for creative use of equipment by practitioners and patients	
	Accessible, comprehensive technical support: locally available and on-call	
	Effective scheduling; integration into the routine	
	Proper facilities: lighting, size, adequate equipment	
	Accessible, sustained staff training (including training at medical school to encourage routine perception)	
	Provision of a eHealthcare coordinator	
	Written policy on reimbursement, liability, cross-jurisdiction use, privacy	
	Sufficient ongoing funding: local, provincial, federal buy-in	
	Speed and quality of network	(Kgasi and Kalema, 2014)
	ICT support service	
	Hardware and software compatibility	
	Reliability of the network	

	Training of users	
Effort expectance	Experience with technology Friendliness of use of technology Vendor support	(Kgasi and Kalema, 2014)
Performance expectance	Quality of service Satisfaction of users Expected benefits	(Kgasi and Kalema, 2014)
Learning	ICT/Internet training for healthcare providers Use of ICT/Internet to enhance education of care providers Involvement of healthcare providers in telehealth/e-health projects	(Chipps and Mars, 2012, Mirkarimi and Behnampour, 2014, Mucheneh, 2014, Habibi-Koolaee et al., 2015, Khoja et al., 2007b)
	Computer skills Lack of time to acquire knowledge	(Simon et al., 2008)
Policy	ICT related regulations; Policies regarding licensure, liability and reimbursement Awareness and support for ICT among politicians; Awareness and support for ICT among institutional policymakers.	(Chipps and Mars, 2012, Khoja et al., 2007b)
Psychological & behavioural	New technology users’ demand Confidence Motivation Competence to perform digital tasks	(Qureshi et al., 2014)

	Encouragement Positive reward Communications that address the differences in attitude and behaviours among different populations.	(Backer, 1995)
Demographics	Gender Age Level of education, Designation Working experience).	(Mucheneh, 2014, Khatun et al., 2015)
Human resource/IT skills	Access to the employees who are familiar with the IT concepts and skills Access to the managers who are familiar with the IT applications and advantages Access to the IT staff with relevant educational degree Holding the high quality training in the field of IT	(Gholamhosseini and Ayatollahi, 2017)
Environmental	Existence of national information policy in the country The security of ICT national networks for commercial transactions Access to the software and hardware in the country	(Gholamhosseini and Ayatollahi, 2017)
ICT functions	Application of network facilities for creating purchase order Application of network facilities for receiving payment Application of network facilities for making payment	(Gholamhosseini and Ayatollahi, 2017)
e-Health	To have the online connection with the patients and performing the remote consultations and procedures Preserving the e-records Planning for the e-health projects Awareness of e-health in hospital	(Gholamhosseini and Ayatollahi, 2017)
Resource	Financial support	(Snyder-Halpern, 2001a)
Knowledge	IT/S Budget and Finance Patterns IT/S Strategic Planning Patterns	(Snyder-Halpern, 2001a)
Process	IT/S Communication Process	(Snyder-Halpern, 2001a)
Value and Goals	Corporate IT/S Philosophy	(Snyder-Halpern, 2001a)
Management structure	Business Plan Communication Structure	(Snyder-Halpern, 2001a)

Administrative support	IT/S Organizational Structure Executive Champions for IT/S Projects Integration of Organizational and IT/S Strategies	(Snyder-Halpern, 2001a)

Source: Developed for this study

Table 2.2 above summarized studies, which focused on assessing the readiness of individuals and organizations and the factors used in the assessment. This is unlike the study conducted by Van Dyk (2014) that largely based on the studies of Khoja et al. (2007b) and Chipps and Mars (2012). There was a range of factors used in assessing readiness, some of which were overlapping with others. For instance, depending on the researcher and the objectives of the research, factors or themes such as *Need-change* (Coleman and Coleman, 2013b, Oio et al., 2007, Paré et al., 2011), *Motivational* (Li et al., 2013a, Li et al., 2012a), and *Core readiness* (Justice, 2012, Durrani et al., 2012, Biruk et al., 2014, Chipps and Mars, 2012, Jennett et al., 2003b, Khoja et al., 2007b, Khoja et al., 2008b, Scharwz et al., 2014, Simon et al., 2008, Li et al., 2010) were used interchangeably. In one circumstance, "*Organization*" was referred to as "*Institution*" (Mucheneh, 2014).

It was known from Table 2.2 above that the most frequent used constructs for the assessment of HIT related readiness. "*Technology readiness*" emerged the most frequently used theme/construct when assessing e-Health readiness at both individual and organizational level with 30 papers, which is equivalent to 46% of the total papers included. Technology readiness in the context of e-Health is the ability of a healthcare organization to meet all the necessary technological requirements in the form of availability of needed hardware and software, network infrastructure and every support necessary to get the systems implemented and running. Twenty-three (23) or 37% of the studies assessed "*Core/Need/Motivational readiness*" healthcare organizations. Core/Need/Motivational readiness is the identification of healthcare services, which when delivered using HITs are capable of improving care quality, accessibility and reduce cost. It can also be a systematic process for identifying and

addressing needs or the gaps between current conditions and desired results (DeGaetano and Shore, 2015). For most authors writing in the context of organizational readiness, one or more of the following constructs were assessed. They are *core/Need assessment/Motivational readiness, Engagement, Technology, User acceptance and Use, Societal, Policy and IT skills/Learning readiness* (see section for "organizational readiness" below for details).

It was no surprise that 29% of the reviewed papers considered "*Acceptance and use readiness*" of various HIT technologies at individual level crucial to the overall readiness of healthcare organizations. Many studies relating to user acceptance have recommended an understanding of issues, which have the potential to affect users prior to implementation (Medhanyie et al., 2015, Nzuki and Mugo, 2014, Banna et al., 2010, Boonstra and Broekhuis, 2010, Dünnebeil et al., 2012, Kruse et al., 2015, LeRouge et al., 2015, Sun and Rau, 2015, Yeo, 2015). Eighteen (18) papers used the construct "*Organizational readiness*". Depending on the authors, organizational readiness assessed varied. Another construct, which appears to be important when planning for the implementation of HITs was the need to engage stakeholders at all levels at all times. "*Engagement readiness*", which had 16 (24%) of the reviewed papers, is conducted in order to create awareness of the intention/plans to roll out HITs and to receive feedback from stakeholders on their take on the said HIT to secure “buy-ins”. Less than one-sixth (14%) of the included reviewed papers on HIT readiness assessed factors affecting “*Societal readiness*” of HIT. Societal readiness assesses the readiness of intending healthcare organizations to link/collaborate with other related or relevant organizations, a very important aspect of e-Health.

One of the architypes of HIT is the potential for healthcare organizations that have adopted it is to be able to break geographical boundaries by being able to provide healthcare services at distance. To do this there will be the need for the identification and assessment of originating and distant sites respectively, which need to be credentialed. While User acceptance and use measures the effort expectancy and performance expectance of stakeholders, in particular end users, “*IT skills/Training/Learning readiness*”, which was assessed by 12 papers or 18% of was in the context of knowledge of systems or required knowledge of systems for effective use. Four of the papers use the construct “*Resource readiness*” to largely refer to the finance and human resource availability. Even though finance and work force seemed to have not been assessed in many studies, but they are seen to be integral to HIT success. It also appears that studies that assessed workforce did that under “*IT skills/Learning construct*” constructs/factors Some of the least factors used in assessing HIT readiness include “*Socio-cultural*” (Qureshi et al., 2014), “*Aptitudinal*” (Mauco, 2014) and “*Attitudinal*” (Mauco, 2014, Mirkarimi and Behnampour, 2014) in the context of personal qualities of users that may influence their readiness to use eHealth. Relatedly, Snyder-Halpern (2001a) also developed and pilot tested measurement scale for Resource, Process, Values and goals, Management structures and Administrative support as assessment factors for organizational information technology/systems innovation readiness scale (OITIRS). Given that generally each of the assessment factors had between one and two measurement tools significantly limits the ability of the measurement tools/scale to effectively assess the readiness factors they were purported to be measuring. Qureshi et al. (2014) and Backer (1995) brought attention to the fact that problem-solving skill development was not a large part of HIT systems capacity building in the past. This is because little is known about how to change behaviour or how to identify the environmental conditions under which the likelihood of behaviour change is greatest.

Further into the review of the included articles revealed “*Community readiness*” as a construct examined by,(Pabst, 2012) and,(Snyder-Halpern, 2001a). It appears, though, that the assessment of such a construct will generally be suitable for small/rural or isolated towns in order to bring a sense of involvement and ownership as with the study by Leon et al. (2012), in which “*Government stewardship*” was assessed in an mHealth initiative in South Africa for the purpose retaining large-scale implementation. In the same context of underdeveloped societies, another factor that was assessed was the “*Socio-technical*” nature of mHealth domain, which examined the relationships between social and technical subsystems prevailing in the developing world in order to facilitate the assessment of mHealth (Tariq and Akter, 2011).

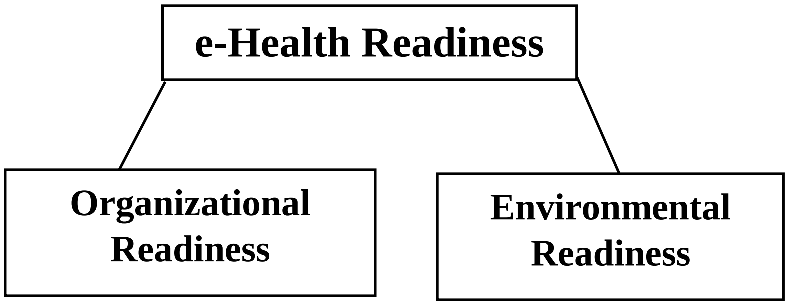
Perhaps one of the most unnoticed invaluable benefit of mHealth would be time-place flexibility as discovered by Okazaki et al. (2013) when assessing clinicians' perception of factors determining mobile health monitoring acceptance. Effectively, mHealth could offer a more cost-effective means for clinicians to engage with patients (Martin, 2012). With the surge in the use of smart phone/PDA, the time has come for clinicians and patients to be able to interact irrespective of the place and time and Marshall et al. (2013) have provided a framework for evaluating the appropriateness of mobile technologies for healthcare.

With reference to the table 2.3, measuring tools above, it appears that authors develop instruments based on the objectives/aims of the studies. Our findings such that the readiness factor with measuring instruments was "*IT Skills/Learning*" with five researchers using all five it measuring tools. Out of the 11 measuring scales for *Core readiness* found, eight (8) were commonly being used. It was apparent that healthcare institutions perceived core readiness and IT skills/learning were fundamental factors when assessing e-Health readiness in healthcare institutions. The remaining constructs barely had more than two authors using their measuring scales suggesting they were unreliable. The lack of standard measuring tools for readiness assessment factors is worrying given the high rate of IS failures.

While qualitative studies did not have survey instruments, many of the quantitative studies had different but related instruments measuring the same constructs. While researches have been conducted in two major economy environments (developed and developing economies), there were no observed differences in the use of readiness factors. In one instance, same author used different instruments in measuring one construct (Motivation) in three different researches (see,(Li et al., 2010), (Li et al., 2012b), (Li et al., 2013a)). There may be a weak agreement or understanding for this myriad use of varying measures given the increasing complexity and the potential for increase failure of IS/T projects in general, which require different projects to be treated differently.

There is invaluable knowledge to gain from the lessons of e-commerce, e-government, and e-health achievements and failures in developed countries through careful examination of those experiences. Relating these lessons to the characteristics of the health sector, organizational and resource readiness of developing countries will be helpful in the selection of appropriate e-Health design and deployment strategies (Rodrigues, 2003). As a result, in this study, reviewed readiness factors have been grouped into two key domains**: organizational readiness and environmental readiness,** which have been shown in previous research to complement and reinforce each other, and when combined to enhance the implementation, quality, integrity, sustainability, and impact of e-Health initiatives.

Figure: 2.1: The impact of the two main readiness factors affecting e-Health



Source: Developed for this study

2.8 Organizational readiness

Organizational readiness for change is considered a critical precursor to the successful implementation of complex changes in healthcare settings (Amatayakul, 2005, O'Connor and Fiol, 2006, Sweeney and Whitaker, 1994). Many promising approaches to improving healthcare delivery entail collective behavior change in the form of systems redesign. This may be multiple, simultaneous changes in staffing, work flow, decision making, communication, and reward systems (Weiner, 2009). What is important in assessing readiness for change is what people believe and their perceptions about support in terms of financial backing, the well-defined mission and leadership structure, the cohesive work team, or the technical skill level needed to adopt a particular innovation (Backer, 1995). These form the core drivers of change and must be given due attention collectively or individually.

The modern healthcare organization (HCO) is largely dependent on IT to accomplish many of its administrative and clinical functions. As a result IT strategic planning has become a critical part of most HCO corporate planning activities (Gunasekaran and Garets, 2004). However, there are well documented problems with the implementation of e-Health initiatives, which demonstrate the gap between research and practice (Murray et al., 2010). IT strategic planning also strengthens the notion that HCOs are lagging behind the non-healthcare industries. While difficulties in implementing e-Health are well known international phenomena (Jha et al., 2008, Ludwick and Doucette, 2009, Murray et al., 2010, Poon et al., 2006), the level of these difficulties are higher in third world countries. The earliest decisions that leading to development projects (or programs) [alongside the identification of analysis and involvement of various stakeholders] are among the most critical in determining long-term success (Watkins et al., 2012).

In planning for e-Health implementation, a needs assessment is the first critical step towards building an effective and sustainable e-Health program. Centralized planning and control of resources, however, discourage innovative involvement from front-line people, which are healthcare providers who typically care about the well-being of patients, possess local knowledge, and are stimulated to contribute when awakened to the need (O'Connor and Fiol, 2006). A needs assessment defines the specific needs of a target population and program, while identifying potentially inaccurate assumptions regarding the value, purpose, or intent of establishing new services. This is “an approach that helps people make informed and justifiable decisions that accomplish desired results (DeGaetano and Shore, 2015)”. Gap analysis, needs analysis, and performance analysis (in so far as strategic planning, focus groups, and multi-criteria analysis are related) have also been borrowed and customized from other disciplines to improve our ability to inform decisions (Watkins et al., 2012). A comprehensive needs assessment including special health characteristics and needs of the population (Mudd-Martin et al., 2014, Turman, 2013) will involve a combination of methods, which allow the organization to "see the full picture", Employing multiple approaches to form a valid and reliable assessment becomes fundamental (Lackner, 2015). Seeing the full picture will require the involvement of multiple stakeholders at multiple stages in order to arrest the concerns of the majority within the framework of IT governance.

IT governance has emerged as a fundamental business imperative, and rightfully so, because it is key to realizing IT business value (Peterson, 2004). IT decisions were made by a few top executives, subordinates did not question their superiors, and company boards rubber-stamped them (McNurlin and Sprague, 2006). IT governance describes the distribution of IT decision-making rights and responsibilities among different stakeholders in the enterprise, and defines the procedures and mechanisms for making and monitoring strategic IT decisions (Peterson, 2004). The application of Information Technology Governance (ITG) was motivated by the private sector in the 90s, as a way to achieve excellence, provide new services, and increase profitability of IT investments (Al Qassimi and Rusu, 2015). A governance cycle defines who has a decision right (the right and responsibility to make a decision) and an input right (the right to provide input to a decision but not make the decision) (McNurlin and Sprague, 2006). E-Health governance is about ensuring effective leadership, coordination and oversight of an existing or ongoing e-Health initiative.

The e-Health leaders' knowledge may consist of the entire IT project management: Initiation, Planning, Execution, Monitoring, Controlling and Project closing (Schwalbe, 2013). In IT project management like in any other project management it is important to remember that strategic planning should serve as the foundation for deciding which projects to pursue, in this case, which e-Health system to implement. Knowledge of IT/S procurement plays a very important role in the successful implementation of any e-Health system for the following reasons:

- reduction in both fixed and recurring costs;
- allow the client organization to focus on its core business;
- access skills and technologies;
- provide flexibility; and
- increase accountability.

2.8.1 Change management

Today's organizations experience frequent, diverse and intense change through practices such as processes redesign, restructuring, mergers, acquisitions and total quality programs. Change is accelerating, competition increasing and access to information expanding (O'Connor and Fiol, 2006). How new systems are 'implemented' remains a problem. An important theme in much recent work has been the problem of 'resisting attitudes of professionals towards e-Health', which is assumed to be the root cause of many e-Health implementation failures (Yarbrough and Smith, 2007). Implementing and leveraging [IT] in healthcare organizations requires stakeholders to change their behaviour. Thus, there are various stakeholder groups that need to be identified, considered, and involved during the implementation process (Lackner, 2015). Put more simply, e-Health initiatives must provide each stakeholder with at least one positive answer to the key change management question: 'Why should I adopt or participate; what's in it for me?' This is the most critical question that must be answered during analysis and design of an e-Health initiative because it grapples with the politics and self-interest that are the strongest determinants of e-Health success or failure (Heeks, 2005b).

In change management, two leadership dimensions (transactional and transformational) have been advanced to explain the impact the leaders of organizations have on the technological change process (Appelbaum et al., 1998). Transactional leadership, which is technical oriented, sees technological change as needing primarily technical solving skills, with little attention given to people problem solving. In effect, the manager lacks the skills required to influence the perception of organizational members exhibiting resistance to the change. The transformational leadership approach, viewing technological change as needing a combination of technical and human relations aspects accepts that managers are given the role of translating top management's vision through exercising their skills of giving direction, problem solving, and implementing to introduce technological change (Beatty and Lee, 1992). A sample list of the focus, activities, and competencies of an effective transformational change methodology suggested by Anderson and Anderson (2010) includes:

"• The understanding that transformation is a multi-dimensional process;

• Conscious change process design: The knowledge and skills for designing a transformational change strategy and process that integrates content and people changes;

• Conscious change process facilitation: The knowledge and skills for learning from and course correcting the change strategy and process throughout implementation;

• Attention to the leaders, the workforce, and all relevant stakeholders;

• The establishment of the required infrastructures, roles, and conditions for success;

• Strategies to deal effectively with the people dynamics of change, individually and collectively, including changing the existing mindset and culture and helping people through their natural reactions to the change; and

• Strategies to manage, support, and permeate the boundaries between the organization's ongoing operation and the rollout of the change".

If an organization is struggling and does not know where to start, it might be beneficial for planners to consult surveys and data sets conducted by government and other accredited relevant organizations to get a general idea of feedback and move forward using the information gathered from that research (Lackner, 2015).

2.8.2 Engagement and buy-ins

This is the process in which [healthcare providers] and community members are actively engaged in the idea of e-healthcare, weighing up its perceived advantages and disadvantages to provide insight into the factors that potentially encourage or impede for e-healthcare adoption (Coleman and Coleman, 2013a). The process involves questioning the benefits of e-Healthcare and expressing hopes, fears and concerns about adopting e-Healthcare.

Existing security vulnerabilities, such as identity theft, loss or theft of mHealth devices and health information raise grave concerns in preserving privacy as well as in promoting user acceptance (Premarathne et al., 2015). Venkatesh et al. (2003, p. 467) reviewed user acceptance literature and discussed eight prominent models in order to propose a unified theory of acceptance and use of technology (UTAUT). The question is: Why have we not seen more successful implementation of information technology in healthcare (Leonard, 2004)? The proliferation of HIT in supporting highly specialized tasks and services has made it increasingly important to understand the factors essential to technology acceptance by individuals (Peeters et al., 2011). In the healthcare organizations, understanding sociotechnical factors, interaction between users and systems and to a lesser extent ergonomics will be more relevant given that healthcare professionals work largely under pressure.

The contribution made by innovation and new technologies to economic growth and welfare is largely determined by the rate and manner in which innovations diffuse throughout the relevant population (Hall, 2004). Adopting new technology is still a major problem in healthcare even though much has been written across a wide range of industries and sectors have undertaken some significant research around the areas of adoption and diffusion of innovation and new technology (Schaper and Pervan, 2007, Rogers, 2005, Rogers, 2003). The nature of the healthcare industry chiefly contributes to its inability to match with other industries, given that any system glitch could put lives of people/patients on the line. Regardless of the industry, the amount of work required to operate an existing system increases instead. Thus, when change through the adoption of new technology occurs because change requires work. This happens during the transition or adoption of a new information system (Leonard, 2004). Leonard (2004) goes on to explain that the degree of increase in the work required, and how long this effect lasts, truly depends on five critical success factors (CSFs):

1. Amount of resistance to change or industry experience in using technology;
2. Amount of training before and during the transition;
3. Amount of buy-in (or contribution) from stakeholder groups;
4. Level of effective reporting on outcome measures during and after implementation (i.e., communication on the technology adoption progress); and
5. Level of effectiveness in dealing with the “breaks” (Leonard 2004 p., 77).

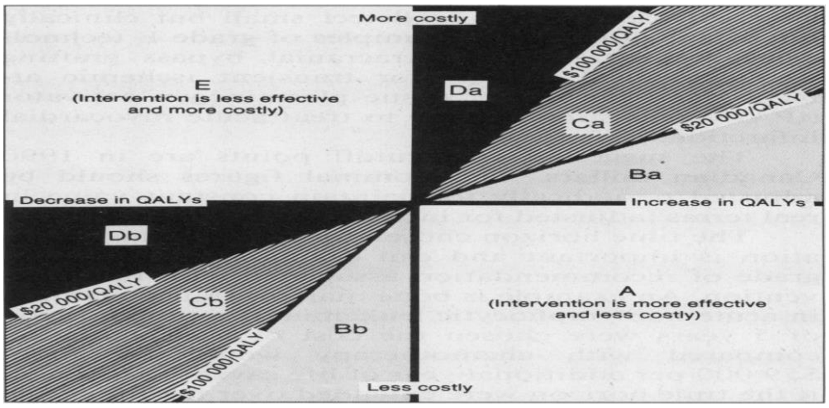
Clearly the most important determinant of the benefit derived from adopting a new technology is the amount of improvement that the new technology offers over any previous technology. At any point in time the choice being made about the decision to adopt a new invention is not a choice between adopting and not adopting, but a choice between adopting now or deferring the decision until later (Hall, 2004).

Technological innovation in health can be an important driver of cost growth (Barbash and Glied, 2010). For clinicians and institutions seeking to adopt technological tools, the investment costs can be high (Doolan and Bates, 2002), and the quality of the decision support that comes with these applications remains highly variable (Metzger and Turisco, 2001), leaving room for uncertainty.

In health, like in other industries, profitability remains a key determinant of technology adoption patterns. Therefore, reduction in profitability would tend to slow adoption – virtually all models of technology adoption concur with this suggestion, see e.g. (Mansfield, 1968, Reinganum, 1989). The development of medical IT applications of has largely been commercially funded, and reimbursement has rewarded excellent billing rather than outstanding clinical care. Put it straight, adoption of functionalities with financial benefits far exceeds adoption of those with safety and quality benefits (Poon et al., 2006). Thus, the focus has been on “back-office” functions (Mansfield, 1968, Reinganum, 1989). This has been in spite of growing interest to adopt HIT to improve safety and quality, adoption remains limited, for instance to the areas of ambulatory electronic health records and physician-patient communication (Poon et al., 2006).

How clinically and economically attractive does a technology have to be to warrant adoption and utilization (Laupacis et al., 1992)? Organizations, particularly physicians' practices, face enormous financial challenges in adopting HIT, and concerns remain about its impact on productivity (Poon et al., 2006). Laupacis et al. (1992) argued and concluded that in general, it seems harder to withdraw an expensive and relatively ineffective technology than to introduce an equally expensive and more effective one. Some health care technologies, however, have been adopted on the basis of weak clinical evidence of effectiveness and without any formal economic evaluation (see Figure 2.2). Grades of recommendation: Grade A technologies should clearly be introduced or continued, and grade E technologies should not be introduced or should be abandoned. Technologies in the upper right quadrant are more effective and costlier than their alternatives, whereas those in the lower left quadrant are less effective and less costly. Introduction of technologies in the upper right quadrant and abandonment of the technologies with the same shading in the lower left quadrant lead to similar degrees of cost-effectiveness (Laupacis et al., 1992).

Figure 2.2: Grades of recommendation for technology adoption and utilization



Source: Adopted from Laupacis et al. (1992)

2.8.3 Value proposition

The health care and business communities today share a fundamental interest in finding ways to achieve higher value in health care (Curfman et al., 2013), taking into account the struggles of every health care system with rising costs and uneven quality and the hard work of healthcare providers. As traditional healthcare settings move toward wellness and population-based health, they are using the Internet to link consumers and organizations (Ball et al., 2001). The ultimate objective for both parties is to keep people healthy, prevent the chronic illnesses that consume a large fraction of our health care dollars, and use medical interventions appropriately (Curfman et al., 2013). These can only be achieved by the early involvement of all healthcare participants leading to the development of medical intervention products with compelling value propositions from all stakeholders. The involvement of healthcare providers or end users in system development also has a direct impact on their behavioural intention to accept and use the system effectively. In effect, healthcare providers, administrators, patients and sponsors such as government and non-government agencies all have compelling reasons to keep the said intervention alive. For instance, in the case of e-Health adoption, patients will be keen to experience improved healthcare accessibility, quality and safety. For healthcare administrators, the adoption of e-Health should offer them the tools for better financial containment and better management of other resources. For providers, clinical effectiveness will be of paramount importance to them. Lastly, for sponsors such as government agencies, the overall efficiency of the entire healthcare system will be of great importance. As more organizations move informatics from theory into practice and realize its value, they will transform inefficient processes and improve care for all (Ball et al., 2001).

In a meeting convened by WHO on e-Health in 2004, it was recommended that WHO adopts e-Health activities that would support information for: 1) health promotion and awareness, medical education, health and biomedical research, evidence-based medicine and e-learning; 2) health information systems (disease surveillance, health statistics, management information systems, financial, logistical, and geographic information systems), monitoring and evaluation; and 3) healthcare delivery: diagnostics, treatment, consultation (telemedicine applications) and electronic patient records (World Health Organization, 2004). Developing countries are constantly working to use ICT in providing health care in order to address issues such as inequalities and to meet international goals of public health (World Health Organization, 2004). In terms of health care, e-readiness is a new concept, which implies the readiness of individuals, societies and organizations to accept e-health programs (Rezai-Rad et al., 2012b).

The main goal of e-Health readiness assessment (EHRA) is to fill the digital gap between health care providers and end-users and to use ICT to have access to public health for all (Khoja, 2007). The former United Nations Secretary-General, Kofi Annan, demonstrated this in his opening statement at the World Summit on the Information Society in Geneva, 2003:

> "The so-called digital divide is actually several gaps in one. There is a technological divide—great gaps in infrastructure. There is a content divide. A lot of web-based information is simply not relevant to the real needs of people. And nearly 70 per cent of the world's websites are in English, at times crowding out local voices and views. There is a gender divide, with women and girls enjoying less access to information technology than men and boys. This can be true of rich and poor countries alike" (United Nations, 2003).

It is useful to understand any limitations on the use of technology due to sex, race, or other socio-cultural factors. One example of the influence of socio-cultural factors is that women and children (especially girls) are the most vulnerable groups in terms of health, but have the least amount of access to ICT.

In his paper, Drury (2005) suggested five elements – the 5Cs that inform the development of e-Health in developing countries. In the **context** of poverty, meeting the Millennium Development Goals (MDGs) and the role ICT can play to support health workers. Then the locally relevant health information **content** accessible to health workers (Coleman and Coleman, 2013a). Providing intra and inter-health facilities **connectivity** that supports the transmission of health knowledge and management information provides an entry-level health information infrastructure. Over such a health facility-based wireless infrastructure it then becomes possible to build workforce **capacity** as well as support **community** development, via the delivery of information to enable better individual and community decision-making in health and other development issues (Drury (2005).

The implementation of e-Health, for example EHRs in developing countries usually involves multiple stakeholders. Patients have a stake primarily because their records are stored within the system. Other stakeholders include care providers, funding and governmental bodies, and the EHRs developer and technical support organizations (Were and Meslin, 2011). This calls for reasonable probability of a favorable risk-benefit analysis for the individual and greater social value to the community, and these should be sustainable over time. But risk and benefit have substantial subjective components, mediated by social and political values, which could include but are not limited to adverse effects or disruption to existing care services and workflows (Were and Meslin, 2011).

2.9 Environmental readiness

The environmental context relates to the acquisition of input by healthcare organizations for operations (Meyer and Goes, 1988). What follows are the aspects of environmental readiness previous discussed.

2.8.1 Technological infrastructure

While the importance of information technology in reducing soaring healthcare costs and enhancing service quality is increasingly being recognized, significant challenges remain in how it is implemented (Turan and Palvia, 2014). The implementation of IT systems is complex and requires adept and adaptability to make it work. The adept could be the understanding of the context of the need for such systems, the selection of the most appropriate systems that will offer value to consumers and remain sustainable. Several factors have been discovered as important variables in defining the successful implementation of e-Health (Qureshi et al., 2013). 'Infrastructural arrangements', however, play a central role and it becomes extremely important in the context of developing countries (Anwar et al., 2011, Kundi and Shah, 2007). Key technological categories are needed to support the successful implementation of e-Health systems. These key technological categories are recognized as Hardware; Network; Related software and Healthcare providers' past IT experience (Coleman and Coleman, 2013a). Technological readiness requires that these technological categories function properly and reliably when necessary (Jennett et al., 2003c) and are located at the convenient reach of healthcare providers. It also means putting in place data and interoperability standards so that information feeds fluidly back into and informs national and sub-national health management information systems (Lemaire, 2011).

Ilie and colleagues posit that healthcare providers' ability to freely and easily access and use these technological equipment have profound impact on their behavioral intention to accept the innovation (Ilie et al., 2009). They further explain that physical accessibility refers to the availability of computers, which can be used to access HIT, while logical accessibility refers to the ease or difficulty of logging into the system.

The findings of Ilie and colleagues was confirmed by Hier et al. (2005). In their study, they found that one central element to acceptance of an EHR is the conservation of physician time, including improving system speed, reducing time spent waiting for a computer to become available, and minimizing time spent documenting care. This finding makes accessibility an important consideration in a physician's decision to use HIT systems.

In digital innovation, networking was the groundbreaking technology/innovation which modified the landscape for the use of ICTs. A computer alone is no longer the central feature of computer based systems, rather it is the node on the network (Qureshi et al., 2013). HIT requires the use of computers in the form of physician digital assistance, electronic health records, computerized physician order entry systems by doctors, patients, hospitals, laboratories, x-ray facilities and all other stake holders (Anwar et al., 2011). Readily available high bandwidth can offer multimedia content, providing healthcare providers with a rich e-Health experience (Jennett et al., 2003c, Wickramasinghe et al., 2005). The lack of appropriate tools and computer systems/utilities to access relevant and quality healthcare information continues to deprive developing nations from realizing the full potential of the networked-world. The assessment of existing network capacity also involves healthcare providers' perception of the reliability and stability of Internet access (Khoja et al., 2007a). Without having a proper Local Area Network (LAN) and Internet facility, inter-organizational and intra-organizational communication is not possible. The LAN is the backbone of any information system (Anwar et al., 2011).

2.8.2 Regulatory policies

The existence of policies at the government and organizational levels to address common issues such as licensing, liability, and reimbursement (Khoja et al., 2008b) is critical to the adoption and use of e-Health by healthcare providers (Cherry et al., 2008). According to Jennett et al.

(2005a), there are three parts to fundamental policies at the organizational level namely:

- Reimbursement and financial incentive to healthcare providers which impact on their behavioral intention to adopt e-Health;
- Healthcare providers' liability; and
- Jurisdiction and privacy (i.e., policies for the security of patient information and protection of patient privacy), which have a direct impact on healthcare providers' use behavior.

The potential benefits of computerization could be substantial, but EHR systems also give rise to new liability risks for health care providers that have received little attention in the legal literature (Hoffman and Podgurski, 2009). Notable among these potential liability risks include but are not limited to unintended effects of automation, data entry errors and inadequate training, multiple use with multiple settings leading to discrepancies in documentation, and potential under-or over medication through provider practices.

2.8.3 Finance and reimbursement

e-Health implementation is capital intensive (Hewitt, 2010) not only for initial cost, e.g. feasibility and consultation, accessible external technical support and system maintenance but also to support project management (e.g., labour costs) and high maintenance cost such as the purchase/upgrade of ICT infrastructure (i.e., hardware, software and Internet access) (Choi et al., 2013). As a result, adequate funding is relevant for continuing professional development. For example, organizational change management (e.g., end-user training conducted by the e-Health vendor and/or employment of an external e-Health coordinator who is familiar with the e-health application and can transfer knowledge to users) (Jennett et al., 2003c, Snyder-Halpern, 2001c). According to Wang et al. (2003) there are two categories of costs associated with e-Health systems implementation: system costs and induced costs. System costs include the cost of the software and hardware, training, implementation, and ongoing maintenance and support. Induced costs are those involved in the transition from a paper to electronic system, such as the temporary decrease in provider productivity after implementation. One of the major obstacles provider organizations face in e-Health systems adoption is an unclear understanding of the return on investment (ROI) (Jha et al., 2009).

e-Health is a new tool for healthcare and self-care, with many different varieties and possible uses. As a result we need to develop different models for reimbursement that enable eHealth services to be widely used (Ahlen, 2015). Reporting in the Australian Business Review, Tasker (2016) quoted the founder of Australian digital health start-up CliniCloud, Andrew Lin as saying "Once telemedicine is reimbursed the same way as an in-person visit, there's no question it will take off". Policies that promote private payer reimbursement for telehealth are associated with greater likelihood of telehealth adoption, whilst policies that require private providers to have a special license to provide telehealth services reduce the likelihood of adoption (Adler-Milstein et al., 2014).

2.8.4 Workforce

For success of e-Health applications, doctors must be given the chance to work jointly with IT-staff to spell out their specific requirements affecting their tasks (Qureshi et al., 2013) and they can only do this with an appropriate level of IT skills. Healthcare provider IT skills can be measured through training received or direct experience in using e-Health systems (Li et al., 2008a). Healthcare providers' IT skills can also be assessed using measures including the regularity of using computers, the Internet, emails and other devices available at work (e.g. Scanners and photocopiers). Healthcare providers' perception of computer self-efficacy has a direct impact on their use (behavior) of the e-Health innovation to accomplish clinical tasks (Kifle et al., 2010). Anwar et al. (2011) also found that e-Health systems or computerized information systems require skilled personnel for their effective operation. Training is one of the most important considerations when implementing any new technology.

Internal technical support, particularly for troubleshooting, takes a leading role in smoothing healthcare providers' transition to the new routine and overcoming their negative attitude towards the new technology, thus facilitating e-Health acceptance and use (Kaushal et al., 2009). Measures to assess the capacity of technical support include the availability of IT support for troubleshooting at the healthcare organization and the providers' perception of service efficiency and effectiveness (Li et al., 2008a). In general, most researchers envisage that irrespective of the status of trained professionals in HIT and allied areas today, the next decade will see a severe increase in demand for such professionals (Hyun et al., 2008).

2.9 Gaps in the literature

There is a general lack of studies on e-Health assessment readiness in developing countries, in particular Africa: (Chipps and Mars, 2012, Coleman and Coleman, 2013b, Coleman et al., 2012, Kgasi and Kalema, 2014) specifically South Africa (Justice, 2012), Nigeria (Mauco, 2014), (Mucheneh, 2014) and Kenya. Only one empirical study in Ghana (Adjorlolo and Ellingsen, 2013) and one from the literature review (Yusif and Soar, 2014) with very limited scopes, which therefore offer little framework/methodology that could be applied to identify the strengths and areas of improvement in various healthcare institutions in Ghana and beyond.

Only one study (Khoja et al., 2007b) conducted in Pakistan developed readiness assessment tools for healthcare providers and managers in healthcare institutions in developing countries.

Given the paucity of studies on e-Health readiness in developing countries, in particular Ghana, there is limited knowledge on the deployment and implementation of electronic health records in developing countries (Sood et al., 2008). This is coupled with about 20 initial small-scale pilot-based e-Health initiatives in Ghana (Afarikumah, 2014) almost all of which are near total decline. Against this backdrop and Ministry of Health Ghana's continual attempt to implement e-Health in selected healthcare institutions; e.g. Korle Bu teaching hospital, Komfo Anokye Teaching Hospital, Wa regional hospital and Zebila district hospital, there is the need for a broader study that will determine the readiness status of healthcare institutions in Ghana to successfully adopt e-Health systems before any further attempts are made.

2.10 Research Question

In most developing countries, e-Health[5] initiatives barely survive beyond the project phase. Many low-income countries have struggled to successfully initiate e-Health projects on a large scale. In light of the reports of e-Health adoptions from other Africas' regions, the poor doctor-patient ratio figures in Ghana, and inadequate health facilities, this study seeks to investigate the readiness of healthcare institutions[6] in Ghana to adopt and sustain an e-Health system. Against this backdrop, the main research question for this study is:

What are the determinants of HIT/e-Health readiness in public healthcare facilities in Ghana?

2.10.1 Research sub-questions

To answer this question, the following supporting sub-research questions need to be answered:

Research Question 1: What factors are perceived to promote HIT/e-Health adoption in public hospitals in Ghana?

Research Question 2: What are the barriers to HIT/e-Health adoption in public hospitals in Ghana?

[5] e-Health in this study refers to the use of ICT for patient record systems in healthcare institutions; processes and procedures in hospital/clinic consultations, prescription and referrals electronically at a distance

[6] Healthcare institutions include hospitals, clinics and clinical laboratories

Research Question 3: What relationships exist among these factors?

2.11 Conclusion

This chapter has presented a review of literature in the area of IT readiness assessment models in healthcare in developing countries. In doing so, various existing readiness and adoption models were reviewed and constructs identified to be used as the basis for this study to further explore themes/constructs to developing an e-Health readiness assessment model for public hospitals in Ghana.

Chapter 3 discusses various IT adoption theories.

CHAPTER 3: REVIEW OF TECHNOLOGY ADOPTION THEORIES

Chapter Overview

In Chapter 2, literature covering the technology of HIT/e-Health, the adoption of a definition for e-Health, selected technologies of e-Health such as electronic medical records (EMRs), electronic health records (EHRs) and the potential benefits of adopting these were reviewed. Common benefits identified include but were not limited to the ability of EHR to capture structured data for better quality of patient care and accessibility of clinical information across the continuum of care. The literature review chapter also discussed e-Health projects in developing countries, e-Health readiness assessment models/frameworks, which lead to the identification of gaps, and the formulation of research questions. From the literature, it was clear that there was a need for more rigorous health information technology HIT readiness assessment studies in particular among healthcare institutions in developing countries. Therefore, this research in the context of developing countries (using Ghana as a case study) will be investigating the readiness of public healthcare organizations to adopt HIT.

This chapter provides a detailed synthesis of major theories of technology adoption at individual and organizational levels respectively. At the individual level theories reviewed included: Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB) (Ajzen, 1991), Combined Theory of Planned Behavior/Technology Acceptance Model (C- TPB-TAM), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). At organizational level theories reviewed were Diffusion of Innovation (DOI), Technology-Organization-Environment (TOE) framework, D&M Information Systems Success Model, Human, Organization and Technology fit (HOT-fit), and Task, Technology-fit (TTF).

3.0 Introduction

Information and communication technology (ICT) has been recognized as an enabling tool which can be used in improving healthcare quality, accessibility and delivery (Blusi et al., 2014, Boyle et al., 2014, Buntin et al., 2011, Hersh et al., 2014, Holroyd-Leduc et al., 2011, Shade et al., 2014). These improvements will only be realized if and when ICTs are widely adopted and used (Oliveira and Martins, 2011). Therefore, it is important to comprehend the factors of IT adoption, as it is consequently essential to know the theoretical models that have arisen addressing IT adoption (Oliveira and Martins, 2011) in particular, theories used by information systems (IS) researchers (Wade and Hulland, 2004). Given that the aim of this study was to explore HIT/e-Health adoption readiness in selected public healthcare facilities in Ghana, numerous theoretical models have been reviewed. This was done in order to consider their applicability in investigating factors influencing healthcare organizations' readiness for HIT adoption.

Broadly, technology acceptance has mainly been studied at two stages: the individual and the organization (Yang et al., 2013). Much of the IT adoption research, nevertheless, has focused on the individual by explaining what influenced their decision to use a particular technology (user adoption and acceptance) (Qureshi, 2014a, Okazaki et al., 2013, Nahm et al., 2008, Mirkarimi and Behnampour, 2014, Lua and Ibrahim, 2015, Duplaga, 2015). Relatively less researches have dedicated to organizational-level adoption to understanding the adoption and diffusion process of an adopting organization (Coleman and Coleman, 2013b, Coleman et al., 2012, Justice, 2012, Khoja et al., 2008b). Furthermore, these studies have all neglected the interactivity between organizations and the environments in which they operate. Therefore, this research study will be focusing on the adoption of HIT in the context of public healthcare organizations in Ghana and the impact of the environment in which they operate in the same perspective.

3.1 Technology acceptance theories at the individual level

Several models of technology acceptance at the individual level have been developed and predominantly used over the years (Oliveira and Martins, 2011). Popular among these are: Theory of Reasoned Action (TRA) Technology Acceptance Model (TAM) (Davis, 1989a), Motivational Model (MM), Theory of Planned Behavior (TPB) (Ajzen, 1991), Combined Theory of Planned Behavior/Technology Acceptance Model (C- TPB-TAM), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT) (Oye et al., 2012). TAM is one of the most dominant additions of Ajzen and Fishbein theory of reasoned action (TRA) (Ajzen and Fishbein, 1975) and Davis and Richard developed TRA (Davis, 1989b, Bagozzi et al., 1992). TAM substitutes many of TRA attitude measures with the two-technology acceptance measures *ease of use*, and *usefulness* (Davis, 1989a). TRA and TAM, both of which have strong behavioral elements, assume that when someone forms an intention to act, that they will be free to act without limitation (Abdelkarim and Nasereddin, 2010). In trying to streamline the model to make prediction of acceptance the TAM model substituted the first three attitudinal constructs from the TPB with two technology acceptance measures: perceived usefulness[7] and perceived ease of use[8]. "Unified Theory of Acceptance and Use of Technology" (UTAUT) "theorizes three direct determinants of Intention to use (performance expectancy, effort expectancy, and social influence) and two direct determinants of usage behavior (intention and facilitating conditions)" (Venkatesh et al., 2003, p. 467). Notwithstanding their value, these models distillate fairly much on individual-level and technological characteristics, overlooking characteristics of the organization (Wolfe, 1994). Diffusion of Innovation (DOI) theory (Rogers, 1995a) is among the user acceptance predictors but can also be used at the organizational level (Damanpour, 1991, Gopalakrishnan and Damanpour, 1997). DOI is reviewed in detailed for its applicability in this research study below.

3.2 Technology adoption theories at the organizational level

Following is a discussion on some notable theories of technology/innovation adoption at firm level.

3.2.1 Diffusion of Innovation (DOI)/Technology-Organization-Environment (TOE)

Roger's DOI theory provides an essential theoretical platform for adoption research in several fields (Rogers, 1995b) and has popularly been applied in examination of organizational adoption of IS over the last two decades (Hsu et al., 2006, Oliveira and Martins, 2011). No single theory of innovation exists, nor does it seem likely one will emerge (Fichman, 2000). The closest the field has come to producing such theory is Rogers' classical model of diffusion (Rogers, 1995b). DOI is a theory of means, reasons, and how fast innovations make their way through cultures, both at the individual and firm levels (Oliveira and Martins, 2011). It has a long history with contributions from sociologists, communication researchers, economists, organizational researchers, IT researchers, and many others (Fichman, 2000). Several studies have combined DOI and technology-organization-environment (TOE) (Tornatzky and Fleischer, 1990). In their study on IT implementation at firm level, Oliveira and Martins (2011) concluded that most empirical studies were resulting from the DOI theory and the TOE

[7] Perceived Usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance DAVIS, F. 1989a. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

[8] Perceived Ease of Use is "the degree to which a person believes that using a particular system would be free of effort" ibid.

framework.

After a critical assessment of existing health information systems (HIS) evaluation studies, Yusof et al. (2008) came up with a framework premised on *human, organization* and *technology-fit* (HOT-fit). *HOT-fit* builds on preceding theories of IS assessment with particular reference to the IS Success Model (Delone and McLean, 2003). The framework has recently been used in the healthcare sphere and has a strong overlap with TOE but excludes "environmental" influence on organizational IT adoption. Even with the inclusion of the organizational context, however, a number of studies (Oliveira and Martins, 2011, Tornatzky and Fleischer, 1990) across other industries show the impact of the environmental circumstance upon the acceptance of IS/IT. Contrasting to *HOT-fit*, the TOE framework does not also have a precise "human" category but may be included in its organizational context.

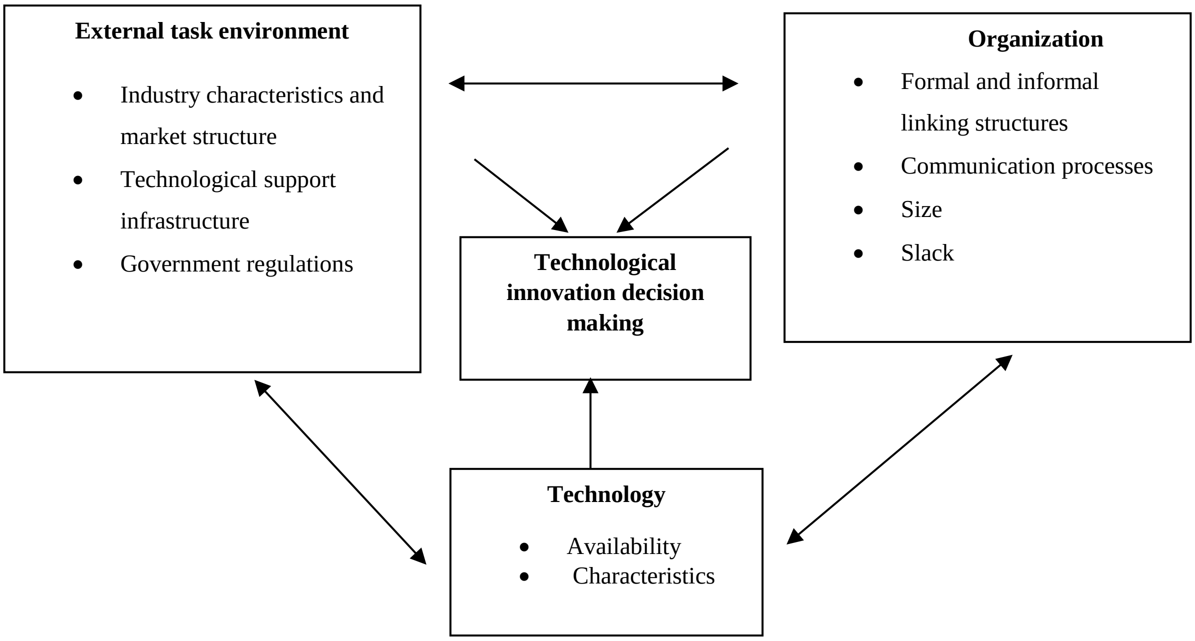
Technology-Organization-Environment (TOE) framework (refer to Figure 3.1 below) assumes a broad group of factors to envisage the prospect of IT acceptance (Awa et al., 2015). The theory posits that adoption is influenced by technological development, organizational conditions, business and organizational reconfiguration and the industry environment (Awa et al., 2015).

The perspective of TOE has been successfully used to comprehend important appropriate factors which decide IT innovation at the organizational level, and health information systems is no exception (Oliveira and Martins, 2011, Dwivedi et al., 2012). In the context of technology, it has been used to test the IT adoption of Web sites for their technological readiness; technological integration; and security application (Martins and Oliveira, 2009, Oliveira and Martins, 2008, Zhu et al., 2006b). Technologically, the theory designates that technology acceptance rests on the collection of technologies internal and external to the firm and the application's *perceived relative advantage, compatibility, complexity, trialability and observability* (Tornatzky and Fleischer, 1990, Oliveira and Martins, 2011). These factors are identified based on the DOI theory (Rogers, 1995b). Relative advantage refers to "the degree to which an innovation is perceived as being better than either the status quo or its precursor" (Rogers, 1995b). For the adoption of the innovation to be effective, key stakeholders in the organization must recognise the relative advantage in using the innovation (Rogers, 1995b, Greenhalgh et al., 2004). For the purpose of this research and in the context of clinicians, administrators, sponsors and patients as stakeholders, "*value*" will be used in place of "*perceived relative advantage*". Compatibility refers to "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential units of adoption" (Rogers, 1995b). Contrary to "ease of use" in the IT adoption literature (Fichman, 2000), complexity refers to *"the degree to which an innovation is perceived as relatively difficult to understand and use"* (Rogers, 1995).

In e-business Zhu et al. (2003a) and Lin and Lin (2008) used the environmental context to analyze consumer readiness, competitive pressure, and lack of trading partner readiness. Other studies also used the TOE framework combined with other theories such as TOE and DOI (Chong et al., 2009, Zhu et al., 2006a) to analyze relative advantage; compatibility; complexity (Innovation); expectations of market trends; competitive pressure (Environmental) and top management support; feasibility; project champions characteristics (Organizational readiness). Soares-Aguiar and Palma-dos-Reis (2008) combined TOE and Institutional theory to analyze the attributes of technological; organizational and environmental contexts of an electronic procurement systems using t-test and logistic regression. Institutional theory argues that the choices made by firms are not motivated by clear objectives of efficacy, but also by social and cultural factors and concerns for legitimacy (Scott, 1995).

The organizational context covers a firm's business scope, top management support, organizational culture, complexity of managerial structure measured in terms of centralization, formalization, and vertical differentiation, the quality of human resources, and size related issues such as internal slack resources and specialization (Tornatzky and Fleischer, 1990, Jeyaraj et al., 2006). The environmental context relates to facilitating and inhibiting factors in areas of operation. Significant amongst these are competitive pressure, partnerships between health care organizations' readiness, socio-cultural issues, government encouragement, and technological support infrastructures (Jeyaraj et al., 2006, Scupola, 2009, Zhu et al., 2003b). In this research study, the environmental context relates to the interaction between healthcare organizations and their environment for inputs such as HIT supporting infrastructure, availability of relevant hardware and software where applicable, and the relationship with relevant state departments/regulatory bodies.

Figure 3.1: TOE framework



Source: Tornatzky and Fleischer (1990)

Given the role of stakeholders in the adoption of innovation, however, hardly will the diffusion of any innovation take place in an organization without key stakeholders acknowledging its relative benefit (Greenhalgh et al., 2004). Therefore, in this research, the acknowledgement of the relative benefits of HIT in the context of "*value*" by clinicians and non-clinicians including hospital administrators will be explored, which makes stakeholder theory potentially applicable to this study.

3.2.2 Stakeholder Theory

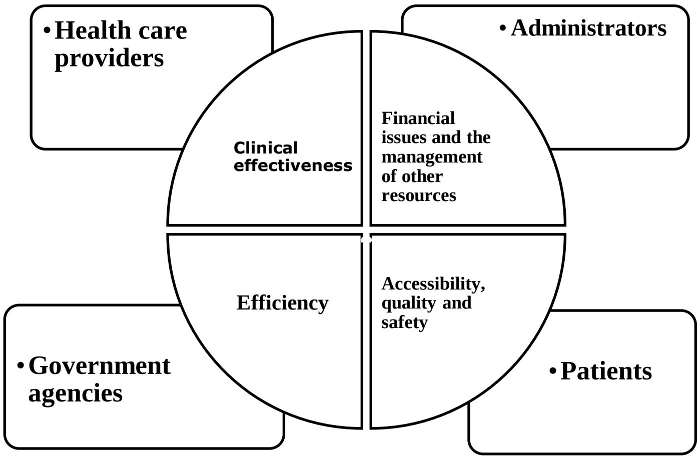
Stakeholder theory identifies and models groups which are stakeholders of a corporation, and both describes and recommends methods by which management can give due regard to the interests of those groups (Freeman, 1984b). Stakeholder theory is based on the stakeholder value, which is to realize stakeholder groups value maximization (Zhang, 2011). The theory argues that there are other parties involved, including governmental bodies, political groups, trade associations, trade unions, communities, associated corporations, prospective employees, prospective customers, and the public at large (Dijkgraaf, 2012).

Contemporary IT system development efforts are typically part of a change process, where the aim is to improve a social setting (Sjostrom and Goldkuhl, 2010). Although the use of the term "stakeholder" in the information systems field is recent, the need to involve certain types of stakeholders in information systems decision-making has been emphasized in the literature for some time (Pouloudi, 1999). Since the inception of the Internet, the technological context of IT development has grown increasingly complex (Sjostrom and Goldkuhl, 2010).

The case for a more holistic view of stakeholders in information systems is made, reflecting the current multi-faceted concerns of information systems development (Pouloudi, 1999). This will enable the notion of 'failure' of IS projects to be understood from the different stakeholders' viewpoints (Sjostrom and Goldkuhl, 2010). When national governments have a holistic view of the stakeholders acting in the electronic commercial market place, they can be sensitive to the specific needs of different interest groups (Papazafeiropoulou and Pouloudi, 2003). Considering stakeholders has received little attention in the context of IT implementations in health (Geiger and Derman, 2003, Grant et al., 2002). Stakeholder theory has not been formally used to study HIT implementations and their impacts (Lapointe et al., 2011). The stakeholders include the following interest groups: the producers of an HIT, its users, the recipients (patients), and the administrators/payers, which include society and experts (Kaplan and Shaw, 2004, Kazanjian and Green, 2002).

Certainly, stakeholder capitalism suggests that consumers are required to be at the center of any process of value creation and trade (Lapointe et al., 2011) with differing needs. For example, while healthcare providers would be seen to be driven by issues of clinical effectiveness of IS systems, administrators and management will be concerned with financial and management issues that have an impact on quality of care (Lapointe et al., 2011). Similarly, government agencies will be focusing on efficiency, and patients will be concerned with accessibility, quality and safety (Lapointe et al., 2011, Lyons et al., 2005) (refer to Figure 3.2 below). Taking into account stakeholder perspectives, varying from an individual residing within a community to national governments through to global organizations, allows health IT interventions to be seen from multiple angles (Hyder et al., 2010). Therefore, for the assessment of the readiness of public healthcare facilities in Ghana, HIT value proposition will be explored in the context of the identification of and development of value driven HIT initiatives.

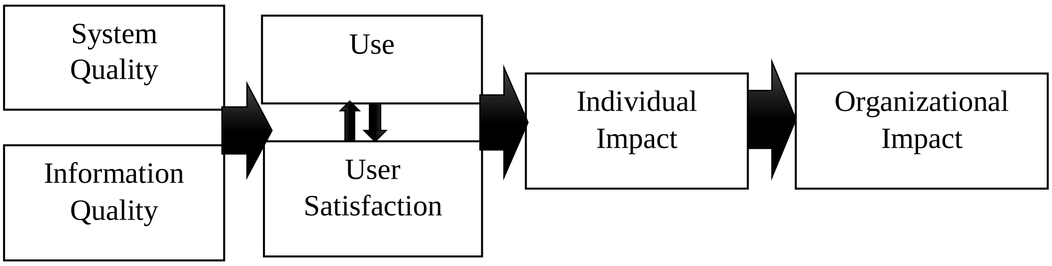
Figure 3.2: HIT value proposition framework



Source: Developed for this study

Examining the perception of IS success, DeLone and McLean (1992) came up with an information success model for management information systems. In the model (IS Success Model) (see Figure 3.3 below), "systems quality" measures technical success; "information quality" measures semantic success; and "use, user satisfaction, individual impacts," and "organizational impacts" measure effectiveness success (Delone and Mclean, 2004). Ammenwerth et al. (2006) disagree. They contend that the model's limitation appears to come from the "stand alone" concentration on IT quality and system quality, demonstrating that only the system's quality itself decides the complete effect, which does not support to describe for what reasons the same IT system can be adopted in a different way, and have rather different effects, in various other settings. Instead, the authors posit that the concept of "fit" is more lengthily detailed in the task-technology-fit model (TTF) (Yusof et al., 2008) in which technology; user and the intricacy of the medical workflows of which an IT system has to support are all considered. As Yusof et al. (2008) noticed with the IS model, however, the TTF model (see Figure 3.4 below) does not comprise organizational factors that are relevant to IS assessment. The authors argued that the indirect nature of the IS model "might lead to spiral" effect in both positive and negative directions. This was in the context of (1) effective use of the system will result in higher net benefits which lead to more intensive use of the system; and (2) insufficient system use will yield lower net benefits; thereby acting as a disincentive to system use (Yusof et al., 2008). Three prerequisites, though, are required for successful IT transformation: organizational vision; organizational corporate strategy (business and IT); and a robust IT infrastructure plus internal and external fit, (limitations from which both TTF and IS models suffer).

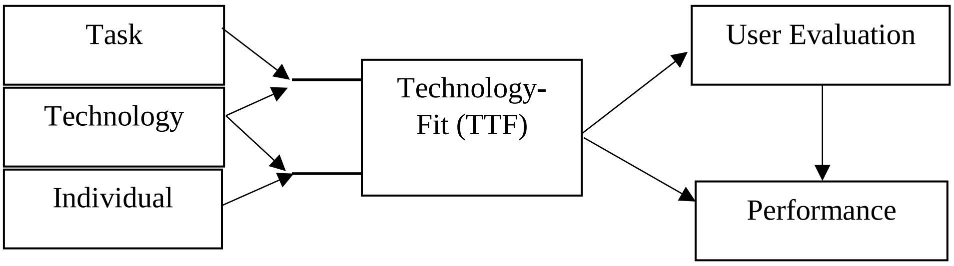
Figure 3.3: IS Success Model



Adopted from DeLone and McLean (1992)

The FITT framework is based on the idea that IT adoption in a clinical environment depends on the fit between the attributes of the separate end-users (e.g. computer anxiety, motivation), attributes of the technology (e.g. usability, functionality, performance), and qualities of the clinical tasks and processes (e.g. organization, task complexity) (Ammenwerth et al., 2006). In their FITT framework, Ammenwerth et al. (2006) failed to account for the likely environmental impact (e.g. partnerships between health care organizations) on IT development and adoption at organizational level, which is why FITT is not applicable to this study.

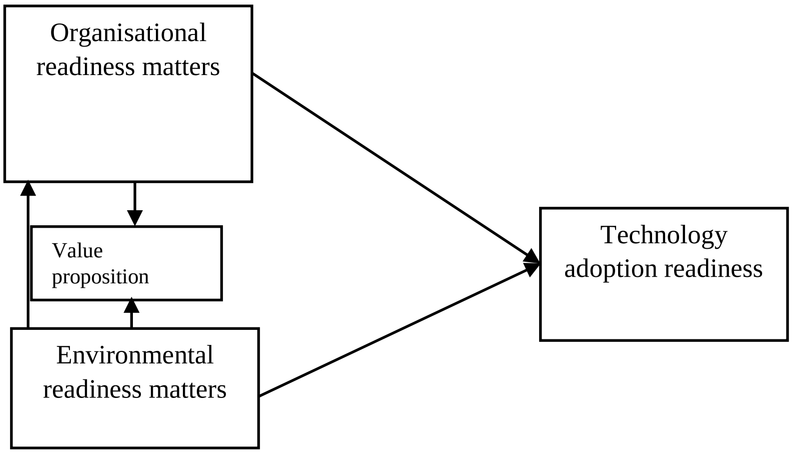
Figure 3.4: FITT framework



Source: Adopted from Ammenwerth et al. (2006)

Based on the strengths and weaknesses of several firm level technology adoption theories including Diffusion of Innovation (Rogers, 1995a); HOT-Fit Framework (Yusof et al., 2008); FITT framework (Ammenwerth et al., 2006); IS Success Model (Delone and McLean, 2003); TOE (Tornatzky and Fleischer, 1990) and Stakeholder theory (Freeman, 1984b) the following conceptual framework was developed from a combination of multiple relevant theories so as to meet the objectives of this study. From TOE framework, based on the organizational and environmental characteristics, it was discovered that technology adoption is influenced by technology development. It was also discovered from the review that technology development is influenced by stakeholders and their needs such as clinical effectiveness of the technology for healthcare providers, efficiency of the technology for sponsors (government and other agencies), the impact of the technology on quality of care for healthcare organizations' administrators, healthcare accessibility, quality and safety for healthcare patients (Lapointe et al., 2011). Stakeholder theory is based on value maximization for stakeholder groups (Zhang, 2011), a gap the stakeholder theory fills. Therefore, healthcare organizations, health providers and healthcare receivers are all impacted by HIT value proposition. Furthermore, value proposition is impacted by the environment/resources. While the needs of stakeholders such as healthcare providers are influenced by the organizational vision, the environment in which the organization operates in turn influences organizational vision. Healthcare organizations transact with their environments to acquire inputs such as patients, capital funds, and legitimacy (Meyer and Goes, 1988). This implies, therefore, that two (2) key domains influence technology adoption. They are **organizational matters** and **environmental characteristics**. This is consistent with the study by Kukafka et al. (2003), which found that 1) IT usage is influenced by multiple factors; and 2) interventions must be multi-dimensional in order to provide additional insight into the reasons for high failure rates associated with underutilized systems. The study also underlines the necessity to change the existing overriding methodology which engages a one-model as guide to IT employment plans that aim to address factors associated with IT acceptance and subsequent positive use behavior (Rice, 2012).

Figure 3.5: Selected theories and their impact on technology adoption in healthcare



Source: Developed for this study

3.3 Conclusion

The review underscored the need to move beyond the current dominant approach that employs a single model to guide IT implementation plans that aim to address factors associated with IT adoption and subsequent positive use behavior. The adoption of TOE framework and incorporation of the role of the stakeholder and the concept of value proposition could better help evaluate technology adoption at firm level, particularly in healthcare institutions.

The methodology chapter is presented next, which discusses the determination of techniques employed to collect data for this research study.

CHAPTER 4: RESEARCH METHODOLOGY

Chapter overview

In chapter 3, a critique of technological adoption theories was performed to provide a basis for the adoption of applicable research methodology for this study. Emphasis was placed on technology adoption theories at the organizational level, which reflect the focus of this research study. This resulted in the selection of TOE and Stakeholder theory on which this research will be premised.

Firstly, in this chapter, an argument on the philosophical standpoint of this research study in relation to the adopted methodology is presented, which will guide the collection of data to answer the research question.

4.0 Introduction

Chapter 3 found that technology adoption has largely been studied at two levels: the individual level and the organizational level (Oliveira and Martins, 2011). However, much of the IT adoption research has focused on the individual level by explaining what influences their decision to use a particular technology. Popular among the theories for technology at the individual level include but are not limited to: Theory of Reasoned Action (TRA) Technology Acceptance Model (TAM) (Davis, 1989a), Motivational Model (MM), Theory of Planned Behavior (TPB) (Ajzen, 1991), Combined Theory of Planned Behavior/Technology Acceptance Model (C- TPB-TAM), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT) (Oye et al., 2012). TAM is one of the most dominant additions of Ajzen and Fishbein theory of reasoned action (TRA) (Ajzen and Fishbein, 1975) and Davis and Richard developed TRA (Davis, 1989b, Bagozzi et al., 1992). Given that the fundamental aim of this study is to identify the key determinants of e-Health readiness in healthcare institutions in Ghana, there is a need to validate various constructs provided by the theories. This validation of applicable and relevant constructs will then result in the development of an e-Health readiness assessment model, which will allow the research team to clarify the ability of healthcare institutions to adopt e-Health technology systems.

Essentially, this chapter discusses the methodological approach and theoretical bases on which this research is carried out and results in a series of activities/plans to undertake this research study. Various research paradigms are also discussed.

4.1 Research philosophy

A research paradigm sets the context for an investigator's study (Ponterotto, 2005) and the assumptions which will underpin the research strategy and the methods chosen as part of that strategy (Saunders et al., 2011). As such, an appropriate research paradigm is an essential theory required for a useful research to be carried out. A research paradigm is an all-encompassing system of interrelated practice and thinking that defines the nature of enquiry along the three dimensions of ontology[9], epistemology[10], and methodology[11] (Terre Blanche and Durrheim, 1999). It refers to a research culture with a set of beliefs, values, and assumptions that a community of researchers has in common regarding the nature and conduct of research (Kuhn, 2011). Kuhn actually defined a paradigm as "an integrated cluster of substantive concepts, variables and problems attached with corresponding methodological approaches and tools…" Ontological and epistemological characteristics concern what is generally referred to as a person's *worldview*, which has significant influence on the perceived relative importance of the aspects of reality (Saunders et al., 2011). Axiology, on the other hand, is the researcher's view of the role of values in research (Saunders et al., 2011). Guba and Lincoln (1994) differentiate between positivist, post-positivist and postmodernist enquiry, grouping postmodernism and post-structuralism within 'critical theory' built on the belief that research paradigms inherently reflect our beliefs about the world we live in and want to live in (Lather, 1986). These substantive concepts provide the philosophical underpinnings that would guide the choice of methodology, comprising ontology, epistemology, axiology and pragmatism in this research study.

4.1.1 Ontology

Ontology is the philosophical study of reality (Saunders et al., 2011). More specifically, ontology addresses the following question: What is the form and nature of reality, and what can be known about that reality (Ponterotto, 2005)? In the context of information

[9] Concerns with the nature of reality, SAUNDERS, M., LEWIS, P. & THORNHILL, A. 2011. *Research methods for business students, 5/e*, Pearson Education Limited, England.
[10] Concerns what constitutes acceptable knowledge in a field of study, ibid.
[11] A system of methods used in a particular area of study or activity.

systems/technology, it is the philosophical study of the nature of information, systems of information and the technology of information. The researcher, from an ontological standpoint, thinks about issues such as whether the world exists independently of any perceptions (Greener, 2011). The main aim of this research is to understand the e-Health readiness situation of healthcare institutions in Ghana and develop an e-Health readiness assessment model. This will be determined by the perceptions of individuals working in e-Health related environments such as senior IT managers and administrative staff of healthcare organizations, leaders/managers of e-Health related initiatives. These perceptions, recognised as intangibles and unconsciously held, would come about as a result of one's e-Health experience. A qualitative approach encouraging participants to describe their e-Health experience would be needed followed by a thematic method of analysing those descriptions to determine the perceptions of participants.

4.1.2 Epistemology

Epistemology is concerned with the relationship between the "knower" (the research participant) and the "would-be knower" (the researcher) (Ponterotto, 2005) and what constitutes acceptable knowledge in the field of study (Saunders et al., 2011). The ways in which that knowledge is developed is dependent on the methodology, and the rigour of that methodology therefore has a direct correlation with the strength of the claim of new knowledge (Oliver, 2010). While positivists emphasize dualism[12] and objectivism, postpositivists advocate a modified dualism/objectivism. A researcher's ontological position links to their epistemological perspective – with the ontological perspective pertaining to the reality of the world and the epistemological perspective pertaining to knowledge of that world. The researcher's ontological standpoint of e-Health readiness being human creation, created through the relationship between the experience of e-Health and the "experiencer" of e-Health supports an epistemological position of using e-Health through subjective, interpretive sense-making and meaning. As Jackson (2013) contends, this view, therefore, has an impact both upon the way the researcher decides to obtain data pertaining to e-Health readiness perceptions and the way in which the data will be analysed in the context of both how e-Health readiness knowledge is brought about and how new knowledge from the research is created.

[12] the researcher and the research participant and topic are assumed to be independent of one another

4.1.3 Axiology

Axiology concerns the role of researcher values in the scientific process (Ponterotto, 2005). Researchers demonstrate axiological skills by being able to articulate their values as a basis for making judgements about what research they are conducting and how they go about doing it (Heron, 1996). Like positivists and postpositivists, Ponterotto (2005) also argues that one's values, hopes, expectations, and feelings have no place in scientific inquiry. Ponterotto on the one hand further argues that by using standardized, systematic investigative methods, the researcher eliminates or strictly controls any influence she or he might have on the participants or on the research process. On the other hand, constructivists–interpretivists hold an opinion that the researcher's values and life experience cannot be divorced from the research process. As a result, in this research study, the researcher would recognize, describe, and "bracket" his or her values, but not eliminate them (Ponterotto, 2005).

4.1.4 Pragmatism

This research will be based on pragmatism philosophical assumptions. This is because the study uses the mixed method approach, which is rooted in the pragmatism philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process(Saunders et al., 2011) (see Fig. 4.1 below). Pragmatism argues that the most important determinant of epistemology, ontology, and axiology a researcher can adopt is the research question (Saunders et al., 2011), (see Table 4.1 below). It avoids the contentious issues of truth and reality, accepts, philosophically, that there are singular and multiple realities that are open to empirical inquiry and orients itself toward solving practical problems in the ''real world". It also allows the researcher to be free of mental and practical constraints imposed by the ''forced choice contrast between postpositivism and constructivism'' (Tashakkori and Teddlie, 1998, Creswell and Plano Clark, 2007). The above authors implied that 'as a researcher, study what interests you and is of value to you (axiological skills), study in the different ways in which you deem are appropriate, and use the results in ways that can bring about positive consequences within the researcher's value system (epistemological stance). Pragmatism in IS was introduced by Goles and Hirschheim (2000). Agerfalk (2010) and Baskerville and Myers (2004) also acknowledged the importance of pragmatism to information systems and emphasised that information systems is often seen as pragmatic discipline with a prominence on practical research, theory and practical implications.

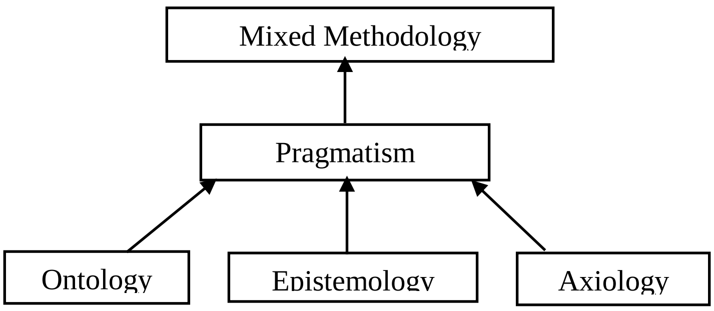
Table 4.1: Pragmatism stance on ontology, epistemology and axiology

Purpose of this research study: The main aim of this research is to understand the e-health readiness situation of healthcare institutions in Ghana and develop an e-Health readiness assessment model

Philosophy	Pragmatism	Context in this research
• Ontology: the researcher's view of the nature of reality or being	• External, multiple, view chosen to best enable answering of research question	• Existence of preliminary/on-going HIT/e-Health project
• Epistemology: the researcher's view regarding what constitutes acceptable knowledge	• Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. • Focus on practical applied research, integrating different perspectives to help interpret the data	• Previous experience in HIT/e-Health related projects required from participants • Use of qualitative and quantitative data
• Axiology: the researcher's view of the role of values in research	• Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view	• Responsible conduct including respect for participants and remaining neutral
• Methodology	• Mixed or multiple method designs, quantitative and qualitative	• Sequential exploratory mixed methodology

Adapted from Saunders et al. (2011)

Figure 4.1: Underlying philosophical assumptions



Source: Developed for this study

4.2 Research Methodology

Research methods are used to reveal the existence of, identify the 'value', significance or extent of, or represent semantic relationships between one or more concepts identified in a model from which statements can be made (Clarke, 2005). There are three alternative approaches used in academic research, which are all applicable to ICT research (Kannampallil et al., 2011, Myers, 1997, Venkatesh et al., 2013). They are qualitative, quantitative and mixed (combination of qualitative and quantitative) methods. Working from the positivist or the post-positivist paradigms, qualitative research is about immersing oneself in a scene and trying to make sense of it – whether at a company meeting, in a community festival, or during an interview (Tracy, 2013). On the other hand the quantitative research with positivism as the current predominant philosophy is a type of research that is `explaining phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics)'(Creswell, 2013).

The newness of HIT in developing countries has affected the rate of successful adoption, particularly in Ghana. As a result, the identification of key determinants – both drivers and inhibitors of HIT adoption is crucial. This necessitates the need for a carefully designed research methodology. In this regard, it was realised upon reviewing relevant literature that both qualitative and quantitative approaches applied sequentially could provide the necessary data to help identify the key determinants. Mixed methods research (MMR)— integrates qualitative and quantitative methods in one study to improve the study's quality (Fidel, 2008). The use of the mixed method approach will help improve the quality of this research study by providing richer data for a better understanding of issues pertaining to healthcare delivery and the foreseeable role of HIT in the context of social and cultural values; the state of healthcare institutions in the circumstance of e-Health adoption; and the development of an e-Health readiness assessment model.

4.2.1 Research methods in HIT domain

The question of which research methods are most appropriate for information systems research has been a focus of concern for some time (Clarke, 2005). In the same context, the concern over the high rate of information systems project implementation failures also continues. Some researchers are of the opinion that the origin of information systems is embedded in a variety of reference disciplines with separate theoretical research perspectives on the important issues to study and the methods to study them (Bariff and Ginzberg, 1982, Dickson et al., 1982). The world of information and communication technology is a fast changing domain, which requires researchers to stay ahead with approaches, which provide solutions to complex problems that are inevitably present themselves. In doing this, Bariff and Ginzberg (1982), posit that a combination of theory-grounded research questions with appropriate methodology should provide an acceptable level of results for both MIS and behavioural science researchers. Their argument implies that no single approach to information systems research can provide the richness that information systems, as a discipline, needs for further advancement (Kaplan and Duchon, 1988). As advocates of mixed-method research have argued, the complexity of human phenomena mandates more complex research designs to capture them (Sandelowski, 2000). A number of research studies in the information domain have used mixed methods including but not limited to (Venkatesh et al., 2013, Teddlie and Tashakkori, 2009, Mingers, 2001, Rocco et al., 2003, McDermott and O'dell, 2001). Generally, the motivation to mix methods in research is the belief that the quality of a study can be improved (Fidel, 2008). Therefore, in this study, a combination of approaches (mixed methodology) will be more appropriate.

4.2.2 Research methodology and design of this study

Mixed research methods is a methodology for conducting research that involves collecting, analysing, and integrating (or mixing) quantitative and qualitative research (and data) in a single study (Bulsara, 2014).

The mixed method provides a better understanding of a research problem or issue than either the qualitative or quantitative research approach alone (Bulsara, 2014). It also sidelines the so called "paradigm wars" (Feilzer, 2010). One of the arguments in the debate about the appropriate methodology for ICT research states that 'IS and IT are so new that it is positively dangerous to allow them to be researched using only one methodology. We stand to lose too much time and potential benefits by doing this' (Fitzgerald et al., 1985). Given that there are still issues of adoption of IT in the health environment, the need to talk in-depth (qualitative technique) with IT managers in the health-related environment for the purposes of gaining understanding of their experiences cannot be over emphasised. Additionally, testing and generalizing/confirming those experiences with a relevant larger population through surveys (quantitative technique) may assist in the quest for a thorough understanding of IT adoption/requirements in the healthcare environment.

Mixed research methods design strategies provide a powerful mechanism for IS researchers to deal with the rapidly changing ICT environment (Venkatesh et al., 2013). To address the research questions for this research study, both qualitative and quantitative approaches respectively (mixed) will be required to collect the right data. In using the mixed method for this study, the qualitative approach will allow the researcher to identify issues pertaining to e-Health implementation in the context of readiness of healthcare institutions in Ghana. The quantitative approach additionally will assist in the interpretation/confirmation of the identified issues by collecting numerical data.

Depending on the research domain and aim/questions, the mixed research methods can be operationalised in three different designs: sequential; conversion; and multilevel (Graff, 2012). Given that the aim of this research study was to explore key determinants of e-Health readiness of public hospitals in Ghana in order to develop a model, the exploratory sequential design will be appropriate as opposed to parallel[13], conversion[14] and multilevel[15] sequential mixed design methods. The sequential mixed designs are used in studies in which one phase occurs after the other i.e., QUAL to QUAN, also known as exploratory sequential or QUAN to QUAL (explanatory sequential). The exploratory sequential design interprets how quantitative results build on initial qualitative results (Creswell and Plano Clark, 2007, Graff, 2012). Table 4.2 below illustrates the implication of the choice of mixed methodology and designs.

Table 4.2: The implication of the choice of mixed methodology and designs

Phase	Activity	Outcome
Phase I	Literature review	Conceptual framework
Phase II	Qualitative data from exploratory interviews	1. Develop preliminary model 2. Development of instrument
Phase III	Collect QUAN data using developed instrument	Confirm developed model

4.2.3 Phase I: Literature review

To advance their collective understanding, researchers and scholars need to understand what has been done before, the strengths and weaknesses of existing studies, and what they might mean (Boote and Beile, 2005). To have an understanding of what has been done and what will be worth doing for the purpose of this study, selected keywords relevant to e-Health readiness/adoption were combined to identify previous studies. With reference to the proposed

[13] QUAL and QUAN data collection occurs concurrently or with a slight time space GRAFF, J. 2012. *Mixed Methods Research. In H.R Hall & L.A Roussel (Eds.) Evidence-Based Practice: An Integrative Approach to Research, Administration and Practice (pp. 45-64). Burlington, MA: Jones & Barlett Learning,*

.

[14] Used in studies in which the collected data are transformed from QUAL to QUAN or vice versa ibid.

[15] May be parallel or sequential with QUAL and QUAN data collected at different levels, analysed separated and integrated to create meta-inferences ibid.

procedures for conducting a systematic literature review by Kinchenham (2009, 2004) the literature research and review was carried out. A thorough, high-level literature review is the foundation and inspiration for substantial, useful research (Boote and Beile, 2005). A literature review goes beyond the search for information and includes the identification and articulation of relationships between the literature and field of research (Urdang, 2011). This literature review had the following goals:

- providing a context for this research;
- justification for the research;
- outline gaps in previous research;
- show where the research fits into the existing body of knowledge;
- review and summarize existing research literature on factors, which influence the success of e-Health adoption;
- outline gaps in previous research; and
- report the results of the research literature review so that people who want to initiate or enhance (Mattessich and Monsey, 1992) e-Health adoption in Ghana and other resource-constraint countries could use it as a guide.

4.2.4 Identification of literature

Articles were searched using Medline/ PubMed, Cinahl, Web of Science, PsychInfo, ProQuest and Google scholar. With these databases known for the publication of e-Health related work, all fields provided were searched. The following search phrases were applied in all databases. "e-Health readiness", "HIT/e-Health readiness assessment", "IS/T readiness assessment", "mHealth readiness assessment", "readiness and implementation, EHR, EMR, e-Prescription", "e-Readiness, e-Health acceptance and use readiness"

The first search phrase for example implied all articles that have the keywords "e-Health" and "readiness". All search phrases in ProQuest included "Full Text". To increase the validity of search the terms "EHR" and "EMR" were specifically used. This was because the EMR/EHR consists of patient health-related information and forms the core of any other HIT systems (Li et al., 2008b). A Prima flow chart diagram (see Figure 4.2) in the article selection process.

4.2.5 Selection criteria

The abstracts of selected articles were reviewed for relevance and inclusion. The following inclusion criteria (see Table 4.3) were used.

Table 4.3: Summary of selection criteria

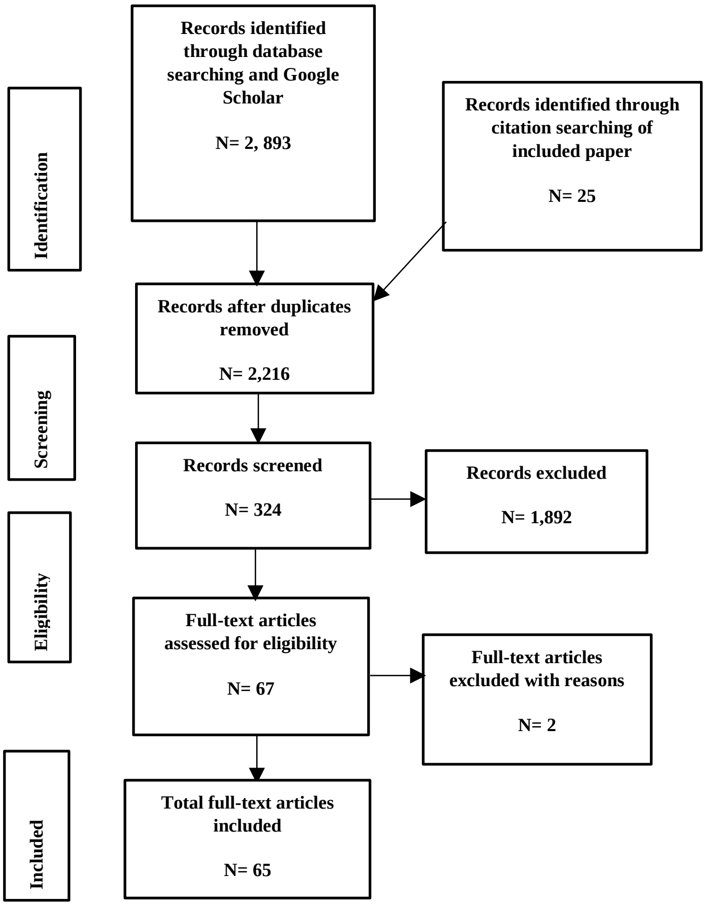
Inclusion criteria	
1. IT/HIT technology	All HIT technologies (e-Health, EMR, EHR, DSS, computerised decision support systems including diagnostic support, alerts and reminder systems;
2. Healthcare facility (hospitals, laboratories)	Primary, secondary, tertiary, rural, urban, public and private healthcare facilities including nursing homes (All healthcare settings and facilities)
3. Study type	Empirical and reviewed studies focusing on all types of HIT system adoption
4. Region	Asia, Africa, North America, South America, Europe, Australia, and Antarctica.
Economic category	Developed and developing countries
Exclusions	
Articles not written in English. Studies (empirical and conceptual) which did not focus on HIT/e-Health adoption/implementation as such did not include key phrases such as "Acceptance readiness", "Adoption readiness", "readiness", "assessment", "Preparedness",	

Source: Developed for this study

4.2.6 Data Synthesis

Data synthesis involves collating and summarising the results of the included studies. Synthesis can be descriptive (non-quantitative) (Kitchenham, 2004). Themes that emerged in the process of the data synthesis were thematically analysed. The definition and explanation of the terminologies given in the articles were studied again throughout the themes to ensure consistency and independence. See Figure 4.2 below, the prisma flow diagram showing articles selection process.

Figure 4.2: Prisma flow diagram showing articles selection process



Source: Developed for this study

4.2.6.1 Phase II: Qualitative method

Qualitative research involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena (Myers, 1997). The idea of electronic healthcare is relatively new in Ghana, as with other developing countries and its use has not yet been part of mainstream healthcare delivery. This makes it imperative to understand the key determinants of its adoption readiness, which could only be achieved by in-depth exploratory interviews with relevant stakeholders. This was in accordance with the goal of qualitative research, which was to understand issues or particular situations by investigating the perspectives and behaviour of the people in these situations and the context within which they act (Kaplan and Maxwell, 2005). Thus, preserving the chronological flow, documenting what events lead to what consequences, and explaining *why* this chronology may have occurred (Tracy, 2013) in relations of reasons, high IS project failures are experienced. There has been a general shift in IS research away from technological to managerial and organizational issues, hence an increasing interest in the application of qualitative research methods (Myers, 1997). For instance, Lapointe and Rivard (2005) conducted a qualitative study of three clinical IS implementations and developed a range of employees reactions to new IS from adoption to aggressive resistance. Similarly, this qualitative phase of the study is expected to record senior health IT related managers' perceptions and other leaders in e-Health related initiatives on the readiness of public healthcare institutions to adopt IT. Literature reviewed found that the successful adoption of e-Health in both developed and developing countries comes with proper attention paid to the technological (Coleman et al., 2012, Coleman and Coleman, 2013b, Chipps and Mars, 2012, Li et al., 2013a, Li et al., 2012a, Overhage et al., 2005, Khoja et al., 2007a, Durrani et al., 2012, Scharwz et al., 2014, Qureshi, 2014a, Qureshi et al., 2012, Mousavi et al., 2015, Khatun et al., 2015, Tamburis et al., 2012, Touré et al., 2012, Simon et al., 2008, Rezai-Rad et al., 2012b, Qureshi et al., 2014, Légaré et al., 2010, Li et al., 2010, Li et al., 2012b, Amatayakul, 2005, Leon et al., 2012, Wickramasinghe et al., 2005, Parker and Demiris, 2004, Coleman and Coleman, 2013a, Mauco, 2014, Yusif and Soar, 2014, Campbell et al., 2001), managerial and organizational readiness (Mucheneh, 2014, Overhage et al., 2005, Adjorlolo and Ellingsen, 2013, Snyder-Halpern, 2001c, Paré et al., 2011, Jennett et al., 2003c, Touré et al., 2012, Qureshi et al., 2014, Ajami et al., 2011, Amatayakul, 2005, Blackman et al., 2013, Leon et al., 2012, Pabst, 2012, Weiner, 2009, DeGaetano and Shore, 2015, Qureshi, 2014a, Qureshi et al., 2012, Choi and Ruona, 2011).

Therefore, gaining the perspectives of stakeholders such as CIOs/heads of healthcare IT institutions, leaders/ managers of e-Health initiatives was an important aspect of understanding the key determinants of e-Health readiness in Ghana.

There are different approaches to qualitative data collection. Popular among these approaches are interviews, participant and non-participant observation (Cooper et al., 2004). In a research study where opinions and experiences of participants about a phenomenon are critical such as this, observation could not be applied given the fact the nature of this study does not provide any room for it. Interviewing is widely used in qualitative research (Edwards and Holland, 2013). Compared with observation, it is more economical in time terms, so as a result, interviewing as means of inquiry was chosen. Interviewing is trying to understand what people think through their speech. Interviews remain the most common methods of data collection in qualitative research and are believed to provide a 'deeper' understanding of social phenomena than observations

(Easterby-Smith et al., 2002; Silverman, 2000). In situations where little is known about a subject (as in this research study) interviews were deemed most appropriate. Likewise, Deegan and Blomquist (2006) also contend that the best way to gather information was to ask the relevant people directly, rather than to use other forms of secondary data. In asking the relevant people, however, as Pontin (2000) cautioned the interview guide/*guide memoire* be piloted first. As a result, the interview guide/*guide memoire* was first e-mailed to all prospective participants a week prior to the actual data collection/interviews sessions. This allowed the researcher to establish if the guide was clear, understandable and capable of answering the research questions, and whether any changes to the interview schedule were required. Follow up e-mails and telephone calls were made to participants to seek any necessary discussion/clarifications on the interview guide/*guide memoire* sent earlier to them.

Qualitative methods may be combined with quantitative methods in conducting a study (Kaplan and Maxwell, 2005). As such, the findings/themes generated from the analysis of the qualitative data collected served as input for the development of an instrument for the collection of quantitative data***. See Chapter 5 for details of the qualitative data collection process***. Following is a discussion on the quantitative method.

4.2.6.2 Phase III: Quantitative method

Quantitative research is defined as social research that employs empirical methods and empirical statements (Cohen et al., 2013) and the application of empirical evaluations (Sukamolson, 2010). Quantitative research is useful to quantify opinions, attitudes and behaviours and to find out how the whole population feels about a certain issue (Sukamolson, 2010). This can be done by firstly seeking the opinions of a small selected group to gain rich information and generalizing/confirming such information numerically (Cottrell and McKenzie, 2010). Similarly, in this research, qualitative data was first collected through one-on-one interviews with key selected senior managers involved in e-Health projects/initiatives in Ghana. The quantitative research approach can be administered through survey, correlation, experiment, and causal-comparative methods (Cottrell and McKenzie, 2010). During the analysis of the qualitative data, themes that were generated were used in the development of a survey instrument. At the core of quantitative data analysis were variables and the relationships that existed between them in order to provide evidence for accepting or rejecting hypotheses (Neuman, 2002). Formulated hypotheses from the analysis of initial qualitative data were tested/validated using a quantitative approach for confirmatory purposes with clinicians and non-clinicians in this research study. ***See Chapter 7 for a detailed quantitative data collection process.***

4.3 Chapter limitations

The data collected for this research study came from senior health related IT managers in a public healthcare environment (13 sets of qualitative data) and healthcare professionals (doctors and registered nurses and administrators (302 sets of quantitative data). As a result, the information provided by participants was assumed to reflect their experiences of the HIT/e-Health situations in public hospitals in Ghana. This information, which came directly from participants' experiences, may not necessarily reflect the private healthcare environment in Ghana as well. In the same context, the quantitative third phase of this study (quantitative data) was conducted at Komfo Anokye Teaching Hospital (KATT), the second largest tertiary hospital in Ghana, which is located in the second busiest city in the country. Circumstances within this hospital and city (Kumasi)/region (Ashanti) may not necessarily be the same with other hospitals in other cities/regions in the country.

Secondly, information received from interviews with senior managers, which contributed to the development of the questionnaire for survey administration, were not measured against any set criteria. However, data analysis and findings were compared with those of previous related studies and other relevant academic literature.

Lastly, the researcher had no control over what information participants provided in both the interview sessions and the administration of questions. Participants were assumed to be aware of any HIT initiatives even though authorities were consulted on the relevance of the research before embarking on it.

4.4 Ethical clearance

Conducting research ethically requires researchers to balance the value of advancing knowledge and non-interference in the lives of others (Langlois, 2011; Neuman, 2007; Cordner & Thompson, 2007). In recent times, the projects of academics working in non-medical research have increasingly come under the regulation of Human Research Ethics Committees. Given the importance of ethics for the conduct of research, research integrity encompasses specific codes and policies, which aim to address some ethical principles such as honesty, objectivity, confidentiality, non-discrimination and respect for intellectual property (Resnik, 2011).

As a rule of thumb, USQ requires Ethical clearance granted for all research involving humans and animals prior to the commencement of any data collection. Furthermore, participants would only agree to participate in research after the grant of ethics clearance from the University. In this research, ethical application was made to the USQ Human and Ethics application committee and was granted, **H13REA149**. To collect quantitative data (conduct surveys), most healthcare facilities would require researchers to be granted ethics approval. The later stage of this research, validation of this model for hypotheses testing at KATH required the granting of ethical approval. Application was made to KNUST/KATH ethics committee and approval was granted, **CHRPE/AP/119/17**.

4.5 Conclusion

This methodology chapter has provided details about the research design and process administered in order to address the research question and to meet the research objective(s) specified in this research study. In the design, sequential exploration was used. This research design was carried out in three phases: 1) literature review helped develop a conceptual framework; 2) initial qualitative data thematically analysed was gathered through one-on-interviews with heads of IT in public hospitals, senior managers of HIT initiatives, lecturers in the field of biostatistics/health informatics to develop a survey instrument ; and 3) themes from the analysis of the qualitative data served as the primary input for developing the survey instrument for the collection of the quantitative data. A confirmatory analysis of the quantitative data confirmed the developed model.

CHAPTER 5: QUALITATIVE DATA COLLECTION

Chapter Overview

In chapter 4, there was a detailed discussion on the research design and methodology employed in collecting data necessary to address the research question for this research study. The research design presented a chronological/sequential application of both qualitative and quantitative approaches to the research methodology.

This chapter presents in a detailed analysis of the qualitative data collection method adopted. It also presents discussions on processes engaged into operationalize the adopted method of data collection based on the perception/experience of senior IT managers in hospitals, IT heads of Ministry of Health, Ministry of Communication, Senior managers of HIT related initiatives in Ghana, and senior academics in the field of biostatistics and health informatics.

5.0 Introduction

There are various methods, which a researcher can adopt when collecting data for qualitative research that include observations, textual or visual analysis (e.g. from books or videos) and interviews (individual or group) (Gill et al., 2008). The most common methods used in healthcare related research, however, are interviews and focus groups (Gill et al., 2008, Britten, 2007, Mears, 2012, Legard et al., 2003). On the one hand, in-depth interviewing is a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program or situation (Boyce and Neale, 2006b). Focus groups, on the other hand, are used for generating information on collective views, and the meanings that lie behind those views (Gill et al., 2008). Both in-depth interviews and focus group methods for collecting qualitative data share the same objective of gathering information-rich data. The techniques classified as “exploratory” generally provide information and insight to researchers as they prepare for larger research efforts such as surveys and experiments (Stringer, 2013).

To emphasise the situations in which focus groups are more effective, Edumond and Morgan posit that focus groups are particularly useful in generating a rich understanding of participants’ experiences and beliefs (Edmunds, 2000, Morgan, 1997). The ability of focus groups to elucidate the experiences and beliefs of participants makes it a qualitative data collection approach with similar capabilities as interviews given the prominent capability of both prominent methods, came the difficulty of having to adopt only one of these data collection methods.

The choice between in-depth interviews and focus groups became difficult due to their similarities. As a result, a number of factors were considered. Noticeable among these were the research domain and characteristics of the sample population. The entire healthcare environment in Ghana is a busy one for all employees. This characteristic made it difficult to conduct focus group sessions. Again, given that HIT research in Ghana is still in its infancy, this implies that little is already known and very few individuals may be knowledgeable enough to provide the necessary information, which made in-depth interviews make suitable for this research study.

5.1 Interviews in qualitative research

The term 'qualitative interview' is often used to capture the different types of interview that are used in qualitative research. Qualitative interviewing varies a great deal in the approach taken by the interviewer (Bryman, 2003). These variations range from the unstructured interview, which comes with an *interview guide,* to the semi-structured interview which has a list of questions or fairly specific topics to be covered, often referred to as an *interview guide,* but the interviewee has a great deal of leeway in how to reply. Unlike interviewing in quantitative research with structured questions, qualitative interviewing tends to be flexible, responding to the direction in which interviewees take the interview and perhaps adjusting the emphases in the research as a result of significant issues that emerge in the course of the interview (Bryman, 2003). As a reminder, the main goal of this study was to explore in depth stakeholders' viewpoints, experiences, feelings, and perspectives on the HIT readiness of public healthcare institutions in Ghana. As a result, the researcher felt the need to delve deeper with interviewees into some key points they may have made in the process of answering a question from an *aide memoire* whenever necessary, hence the adoption of the in-depth interview approach.

The in-depth or unstructured interview is a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation (Boyce and Neale, 2006a). As with other larger research projects, in this study too, in-depth interviews were conducted at the beginning (Wallace Foundation, 2009) as an initial tool towards the collection of quantitative data. This was done in order to provide context to other data and provide an opportunity for the researcher(s) to handpick a specific sample for rich data purpose.

5.2 Justification for in-depth interviews

As suggested by Gill et al. (2008), interviews are, therefore, most appropriate where little is already known about the study phenomenon or where detailed insights are required from individual participants. Seidman (2013) also explains that the purpose of in-depth interviewing is not to get answers to questions, nor to test or evaluate hypotheses, as the term is used, but for an understanding of the lived experience of other people and the meaning they make of that experience. Hence, in this research study, interviews were used to explore the views, experiences, beliefs and motivations of individual respondents. Furthermore, the difficulty of sampling the population of senior managers who, at the best of times are busy and can only afford to participate in research when the time is appropriate for them in the context of their work, motivated the adoption of the in-depth interview technique.

The primary advantage of in-depth interviews is that they provide much more detailed information that which is available through other data collection methods and in a more relaxed atmosphere (Boyce and Neale, 2006b). In-depth interviews are a particularly good choice for getting qualitative data in cases where it would be logistically difficult to gather all relevant participants into one room at the same time (Wallace Foundation, 2009) as was the case in this research. In-depth interviews are also useful when a researcher wants to collect detailed information about a person's thoughts and behaviours or wants to explore new issues in depth. Interviews are often used to provide context to other data (such as outcome data) (Boyce and Neale, 2006b), and in this case build up to a quantitative data source later in the research process. They are often used to refine questions for future surveys by a particular group (Boyce and Neale, 2006a). As with this research study, the outcome of the analysis of the qualitative data will serve as input towards developing a preliminary model and survey questionnaire. The following table summarises the advantages of in-depth interviews and their applicability to this study.

Table 5.1 Advantages of in-depth interviews and their implication to this study

Advantage	Applicability to this study
Quality of data: Skilled interviewers are able to respond to questions and probe for detail (Wallace Foundation, 2009).	Interviewees provided an unlimited account of how they perceive HIT adoption/readiness on institutional capacity.
Questions can be added or altered in real time if needed (Wallace Foundation, 2009).	The researcher followed up some elaborations/answers with further questions, in order to elaborate answers.
Offers a more complete picture of what happened in the program and why *(Boyce and Neale, 2006b)*	Allowed the researcher to have an overview of issues of HIT projects/adoption in various public healthcare facilities in Ghana
Help to distinguish individual (as opposed to group) opinions about the program *(Boyce and Neale, 2006b)*	Interviewees provided brief accounts of some issues they perceived to be sensitive and peculiar to them as individuals discussing their institutions, which helped in the analysis of the data for themes.
Aide memoire has the potential to provide rich data	Allowed interviewees to express their views with no limitations
Short timelines: Data can be collected faster than other research methods—usually within a few weeks (Wallace Foundation, 2009).	Easy to secure individual interview appointments anytime, which allowed the researcher to gather quick data as multiple interviews were conducted on the same day.
Potential to facilitate data analysis	During data analysis, the researcher reminisced on individual interview situations, which facilitated data analysis.
Suitable for non-generalizable data/sample	There are a limited number of HIT initiatives in Ghana. As such only a handful of individuals have been involved in HIT cases.
Interview functions much more like a moderator guide, with no scales-respondents answer in their own words *(Boyce and Neale, 2006b)*	The interviewer adjusted the order and flow of the questions and asked additional questions as needed.

Source: Adapted from Wallace Foundation (2009) and Boyce and Neale (2006b)

Apart from the advantages tabulated above, there were also some aspects of in-depth interviews that presented some challenges. In such circumstances, meticulous steps were employed to minimise the potential effects of such challenges on the outcome of this research. Notable examples are summarised in table 5.2 below.

Table 5.2: Challenges of in-depth interviews

Challenge	Minimization intervention
Data gathered could not be generalized	Qualitative data analysed to develop instrument for survey administration
Tendency of interviewees to exploring unrelated issues	The researcher will intervene from time to time with key questions that bring interviewees back on track.
Appointments prone to cancellation	Researcher required to issue follow-up e-mails and phone calls to remind participants and confirm availability for the scheduled times
Data gathered from interviewees were personal opinions and as such had the tendency of being biased	Researcher maintained neutral position throughout the interviews to ensure interviewees stay focus led.
Analysis can be challenging, time-consuming	Organization of data into tables containing questions and answers provided by various interviewees
Interviewing requires a high level of training and skill	Researcher had undertaken earlier research scoping interviews with most of the interviewees so gained some experience

Source: Source: Adapted from Wallace Foundation (2009) and Boyce and Neale (2006b)

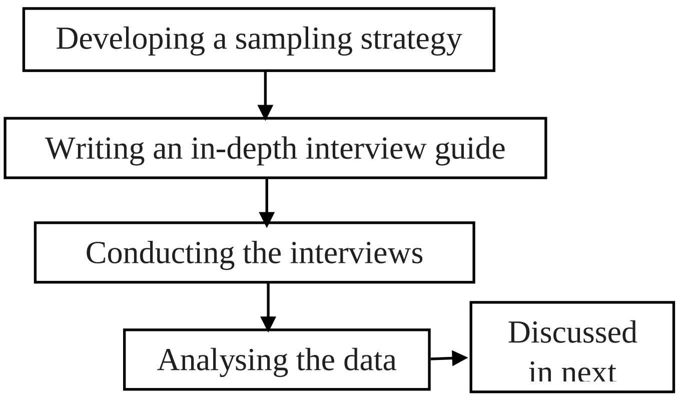
The themes, which emerged from the analysis were used as key input towards the development of the survey questions for the commencement of the third stage of the research process, in which quantitative data was to be collected. The use of in-depth interviews gained recognition in information IT/S, (see Liao et al., 2016, Gable, 1994). The qualitative data gathered and analysed in this phase will influence the outcome of the quantitative data that would be gathered in the next and final phase of data collection. As per the objectives of this study, which informed the choice of a mixed exploratory sequential method, the main aim of collecting qualitative data was to complement the latter stage, quantitative data collection, and not compete with the quantitative data in any context. Against this backdrop, the qualitative data collected contributed to this study in the following capacities:

1. Provided first-hand information on the views of senior IT managers in the healthcare environment concerning HIT in Ghana and other developing countries;
2. Added fresh data to the already existing limited data on the ability of public hospitals to implement HIT in Ghana;
3. Provided a base to confirm and reject the findings of previous related studies in other developing countries regarding the myth surrounding the use of IT in the healthcare environment; and
4. Most importantly, provided data, which after analysis, has the potential to indicate means of redressing some of the burgeoning issues that are capable of undermining efforts to improve HIT adoption by state healthcare facilities in Ghana.

5.2.1 Data collection process

The following four (4) steps (see figure 5.1) were taken during the data collection process. These steps served as the framework/guide towards the operationalization of all the relevant data collection strategies below.

Figure 5.1: the qualitative data process employed in this research study



Source: Developed for this study

5.2.2 Developing a sampling strategy

The following sampling techniques were adopted as part of the sampling strategy.

5.2.2.1 Study population (Sample)

A research sample is "a smaller (but hopefully representative) collection of units from a population used to determine truths about that population"[16] (Field, 2005). Sampling is an important component of any piece of research for the purposes of gathering data about the population in order to make an interpretation that can be generalized to the population in question. The sample for this study (see table 2 below) was drawn from the target population[17] of CIOs, hospital administrators of participating hospitals[18], and leaders/managers of various e-Health initiatives in Ghana. This population, believed to have the required knowledge needed to participate in this research study is involved in various e-Health initiatives in Ghana including a preliminary implementation of EHR systems in the above-mentioned participating hospitals. In addition to their knowledge about e-Health, previous small-scale e-Health research studies including (Achampong, 2012, Adjorlolo and Ellingsen, 2013, Afagbedzi et al., 2013, Afarikumah, 2014, Sarfo and Asiedu, 2013) have used a similar sample.

There are three aspects of samples. They are: sampling frame[19]; sample size; and sample selection (Fowler Jr, 2013). Obtaining a sample size that is appropriate in all regards is critical for many reasons. Most importantly, a large sample size is more representative of the population, limiting the influence of outliers or extreme observation (Patel et al., 2003). According to Griffin and Hauser (1993), for in-depth qualitative research studies, 20-30 in-depth interviews were considered necessary to uncover 90-95% of all issues under consideration for the purpose of generalization. For a third world country such as Ghana, however, and given that HIT is still in its infancy stages, 13 participants with the relevant experience participated in this stage of the research. At interview 13, the researcher noticed that no new information was forthcoming. Information provided by participants after interview 8 (9-13) confirmed those provided by interviewees 1 – 8. At this point, the researcher declared a point of saturation for the collection of the qualitative data.

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16 The larger group from which individuals are selected to participate in a study

17 In this study is a set of elements larger than the population sampled and to which the researcher would like to generalize study findings.

18 Plans are underway to implement e-Health systems in participating hospitals

19 A list or map that identifies most units within the target population WILMOT, A. 2005. Designing sampling strategies for qualitative social research: with particular reference to the Office for National Statistics' Qualitative Respondent Register. *SURVEY METHODOLOGY BULLETIN-OFFICE FOR NATIONAL STATISTICS-*, 56**,** 53.

Table 5.3: Sample for data collection

	Distribution of sample	Location	Sample	No. Invited	No. Participated
1	20 e-Health projects	Accra	Project leaders/Managers	20	2
2	37 Military Hospital		Head of IT	1	1
3	NITA	Accra	Head of IT, Head of applications and Director General	3	1
4	eGovernment Ghana (MOC)	Accra	Coordinator	1	1
5	MOH	Accra	HIT coordinator	1	1
6	GHS	Accra	Head of IT, Administrative Manager	2	2
7	SPH (Dept of Health informatics)	UG	lecturers	3	1
8	NHIS	Accra	Director of information management	1	1
9	Korle Bu Teaching Hospital	Accra	Head of IT, Senior Admin officer	2	1
10	Komfo Anokyi Teaching Hospital	Kumasi	Head of IT, Senior Admin officer	2	2
Total				**36**	**13**

Source: Developed for this study

5.2.2.2 Sampling technique

Mixed methods sampling requires an understanding and acknowledgement of the sampling strategies that occur in QUAL and QUAN research. While there was no explicit definition for sampling in their study of literature on sampling, Gentles et al. (2015) defined sampling as 'the selection of specific data sources from which data are collected to address a research objective'. The application of their definition of sampling in this study implies an act of careful selection of a reasonable representative population with attributes capable of determining the characteristics of the entire population relevant to this study[20]. The two broad sampling techniques can be grouped under two broad headings: probability (Random) and purposive (non-random). Probability sampling techniques are used most often in QUAN research to obtain a sample that most accurately represents the entire population (Brady, 2013). At this qualitative phase of the study, the purposive sampling approach was adopted.

Purposive sampling is widely used in qualitative research for the identification and selection of information-rich cases that exhibit knowledge in or experience with phenomena of interest and for the most effective use of limited resources (Palinkas et al., 2015, Patton, 2002). A

[20] Adopted definition for the purpose of this study.

purposive sampling technique assumes that a researcher's knowledge about the population can be used to handpick the cases to be included in the sample (Polit and Hungler, 1997). In addition to knowledge and experience, Bernard (2011) notes the importance of availability and willingness to participate, and the ability to communicate experiences and opinions in an articulate, expressive, and reflective manner. Popular sampling techniques include snowball or case sampling[21], random sampling[22] stratified purposive sampling[23] and convenience sampling[24] (Patton, 2002).

5.2.2.3 Recruiting sample

Recruitment of participants was one of the most challenging aspects of this research study because of the nature of participants and their working environment. Recruitment is the dialogue which takes place between an investigator and a potential participant prior to the initiation of the consent process (Patel et al., 2003). The main goals for recruiting participants for this study were twofold: Firstly, to recruit a sample that adequately represents the target population; and secondly, to recruit sufficient participants (Hulley et al., 2001, Keith, 2001) to meet the anticipated sample size recommended for the collection of qualitative data through in-depth interviews. The recruitment exercise began with the identification, targeting and enlistment of participants for this research study. It involved providing information to each potential participants and generating their interest in the proposed study (Patel et al., 2003).

5.2.2.4 Recruitment techniques

Successful participants' recruitment was an important aspect of conducting this research study. Researchers conducting qualitative studies in health-related fields encountered challenges in recruiting specific target populations (Namageyo-Funa et al., 2014). During an initial research scoping discussion trip to Ghana in 2015 to investigate whether the study of "The HIT adoption readiness of public hospitals in Ghana" was worth investigating further, the Ghana Health Ministry helped identified both Korle Bu and KATH Teaching hospitals as healthcare institutions that have preliminary HIT related implementation projects underway. After meeting the head of IT at Korle Bu Teaching Hospital, he referred the researcher to three of his

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[21] Seeking information from key informants about details of other 'information-rich cases' PATTON, M. 2002. Qualitative Research and Evaluation Methods, 3rd edn Sage. *Thousand Oaks, California*.
[22] Sampling technique where we select a group of subjects (a sample) for study from a larger group (a population) ibid.
[23] Samples within samples' with each stratum being fairly homogeneous ibid.
[24] Involves selecting reports that are 'easy to access and inexpensive to study' ibid.

working team members at various health related institutions with referrals followed from them. The referrals served as the main strategy in recruiting relevant participants in this research study. This was because the main goal of purposive sampling was to focus on particular characteristics of a population of interest, which will best enable the researcher to answer the set research questions. The sample being studied was not representative of the population, but for research such as this (pursuing initial qualitative data for larger quantitative data in the latter stages or mixed methods research designs), this was not considered a weakness.
After meeting various interested participants, "advance notices" and a draft interview protocol was e-mailed to them. "Advance notice" is a known technique that has been found to be effective in enhancing response rates (Edwards et al., 2002, Fox et al., 1988). In the advance notice, the relevance of the research study was stressed.

Purposive samples, irrespective of the type of purposive sampling used, can be highly prone to researcher bias. In this case, a risk of bias was evident because participants could actually know each other and could discuss research interviews with other potential participants before the interview was actually conducted. That is not to say that information provided by participants in the qualitative study was not based on their genuine beliefs and experiences/knowledge.

5.2.2.5 Participating institutions

The healthcare system in Ghana is grouped into three sectors: the public sector (managed and funded by the government); the private sector (owned and managed by individuals/group of investors); and those run by non-profit organizations.

With the goal of providing health care to all by attempting to remove cost as a barrier, the government of Ghana created the National Health Insurance Scheme (NHIS) in 2003, and this program became fully operationalized in 2005 (Singh et al., 2015). From the very beginning, eligible beneficiaries would access healthcare and later the state insurance would reimburse the facility that the patient accessed. This reimbursement process could take up to seven months to process because claim applications were paper-based. The NHIS agency then authorised all healthcare facilities to only submit claims electronically. Healthcare facilities were forced into partnerships with the insurance agencies to implement eClaim systems to that effect. Since then many public healthcare facilities have started exploring how additional electronic systems that include clinical components could be implemented in partnership with other state organizations such as the national information technology agency (NITA), the Ministry of Health (MoH), the

Ghana health services (GHS), the Ministry of Communications (MoC) and the NHIA. Therefore, all participating hospitals have been working on some sort of HIT system.

5.2.3 Writing an In-depth Interview guide

An in-depth interview guide or *aide memoire* is a list of relevant topics/questions used as a guide for an interview used to ensure that all the important questions are asked and not forgotten. It contained the questions/lists of topics to be covered during the interview. The interview guide or *aide memoire* would probe the following identified HIT readiness assessment constructs: *Core readiness, Engagement readiness, Change management readiness, Technological readiness, HIT funding readiness, Regulatory and policy readiness, and Workforce readiness.* The specific objectives in mind at the time of writing the interview guide were to:

- Identify key concepts/themes, which could be used in assessing/measuring individually explored and newly identified factors where possible from key stakeholders based on their experiences from any involvement in HIT projects.
- Use the outcome of the analyzed qualitative data (concepts/themes) to develop a survey instrument for quantitative data.

The In-depth interview guide further helped in this study in investigating other related issues that arose during the interview – including the unexpected. Unlike moderator guides, in-depth interview guides have fewer components and did not include ground rules (Wallace Foundation, 2009). The components were applied during the development of the interview guide for this study:

1. The purpose and introduction: The introduction comprised the purpose of the interview that was capable of convincing a potential respondent to participate in the interview. This was followed by the introduction of the interviewer and the reason the research was being conducted. The topic was introduced in such a way that it did not give away too many details about exactly what the participants were going to be asked. It was, however, sufficiently informative to get them to agree to participate.
2. The questions, which make up the major part of the guide; and
3. The conclusion, which allows the interviewer (researcher) to end the interview by asking the respondents if they have any further comments about the topic.

Source: Adapted from Wallace Foundation (2009)

5.2.4 Conducting the interviews

In conducting the actual interviews with the participants who agreed to participate in the research study, it was vital for the interview to be conducted in an environment in which the respondents felt most comfortable, for example their work places (hospitals and working offices). In other words, data collection/interviews took place in the natural setting of the study (hospitals) because qualitative methods seek to describe, explore and understand phenomena from the perspective of the individual participants (Noble and Smith, 2014). Participants who had their own office opted to be interviewed in their offices whereas those that shared office used other unoccupied office space within their working premises. The researcher and participants made advance appointments as per the availability of the respondents in most cases. The researcher began the interview with a clear understanding of the participants in terms of backgrounds and the number of years working in their current institutions. In conducting the interviews, the following process, as recommended by Boyce and Neale (2006b) was adopted by the researcher as it laid the ground rules for good interview practice:

1. Set up interviews with stakeholders, explained the purpose of the interview, why the stakeholder had been chosen, and the expected duration of the interview);
2. Sought informed written consent of the interviewees. The researcher then re-explained the purpose of the interview, why the stakeholder had been chosen, expected duration of the interview, use of a note taker and/or tape recorder and USQ data storage policy;
3. After the interviewees consented, the researcher conducted the interviews, which were audio-recorded on an iPhone;
4. Summarized key data immediately following the interview; and
5. Verified information given in interviews whenever necessary.

5.3 Qualitative data analysis

Qualitative research is a generic term that refers to a group of methods and ways of collecting and analysing data that are interpretative, exploratory or explanatory in nature and focus on meaning (Noble and Smith, 2014). In this research study, like many others, much contemplation took place as to which method of data collection was most appropriate. Every justification was provided in support of the choice of in-depth interviews including the topic under study and the research settings. Furthermore, given that the theme induced/identified from the analysis of initial qualitative data would serve as input towards the development of an instrument for the survey questionnaire, thematic analysis emerged as the favourite method of analysis. As such, themes were the main outcome of thematic analysis. The nature of this study does not enforce the recurrence of ideas to be coded or themed. They have to, however, be present. They could however be induced if necessary since the literature reviewed identified certain common/regular themes/variables.

Notwithstanding the diversity of qualitative methods, the following outlined process of analysis was based on a common set of principles for interview data recommended by O'Connor and Gibson (2003):

1. Transcribing the audio-recorded interviews;
2. Organizing the data and immersing oneself within the data to gain detailed insights into the experiences/perceptions of HIT managers being explored;
3. Finding and organizing ideas and concepts thereby developing a data coding system;
4. Linking codes or units of data to form overarching themes/concepts;
5. Ensuring reliability and validity in data analysis; and
6. Finding possible and plausible explanations of the findings to communicate findings and their implications **(ref to Chapter 10).**

5.4 Limitations of In-depth interviews

In-depth interviews, as with many other research methods/data collection instruments, demonstrate some limitations for qualitative data collection in this research study. Firstly, interviewees may have been prone to providing answers that reflected their feelings/understanding about the state HIT adoption due to their stake. To address this limitation, the researcher remained neutral throughout interview sessions and always and focused on the interview guide. Secondly, the interviews were time-intensive assessment activities because of the time it takes to conduct the interview, transcription of audios recorded, and analysis of the transcribed data, resulting in a more difficult analysis. Thirdly, given that there is no standard number of interviews, (despite between 10 and 15 interviews are not being uncommon, the length of each interview and the number of in-depth interviews the researcher completed for this research project was 13 and not generalizable (Boyce and Neale, 2006b, Wallace Foundation, 2009).

5.5 Discussion

The analyses and the findings from the qualitative data was meant to help develop a survey instrument in order to collect quantitative data test or generalize the initial findings and interprets how the quantitative results build on the initial qualitative results (Creswell and Plano Clark, 2007) in the context of the overall predictability of the developed model. As such, the adoption of an in-depth interview strategy assisted in the collection of initial rich qualitative data regarding key determinants of HIT readiness of hospitals in Ghana from key stakeholders.

In addition, the in-depth interviews offered respondents the enabling environment to be able to provide information that was required to substantiate a questionnaire instrument necessary for generalization and confirmation of the developed model.

5.6 Conclusion

This chapter has provided details of the approach employed in collecting qualitative data, in particular, in-depth interviews. The chapter expounds that in-depth interviews are a credible means of capturing opinions/experiences of any particular interest group as with this research study. The chapter further provided detailed information about strategies and processes that were used to capture those opinions. Effectively, strategies involved in identifying sampling a population and recruitment, the process of developing an interview guide, conducting interviews and the methods of analysing the collected data have all been discussed.

In Chapter 6, detailed information about the analysis of the data gathered is provided. This will predominantly concern the development of themes to enable the development of a survey questionnaire for the collection of quantitative data.

CHAPTER 6: QUALITATIVE DATA ANALYSIS

Chapter Overview

In the preceding chapter, details about the activities and strategies used to collect qualitative data were provided. The chapter discussed a four-step approach that was used in collecting data from study participants. The four-steps that were practically followed were: the development of a sampling strategy in order to make sure the right population were recruited to obtain pertinent information; the process of writing an in-depth interview guide/*aide memoire* with relevant objectives in mind to capture relevant information from participant; the actual interviewing, which detailed all the steps and channels used to make respondents feel comfortable, in order to provide relevant information; and finally transcription of the audio-recorded interviews for analysis in chapter 6.

This chapter analyses the qualitative data collected for the purpose of identifying themes and concepts as its main outcome, will demonstrate all the relevant steps and activities to be engaged in, in order to identify themes. By doing so the output will serve as input towards the development of a preliminary HIT adoption readiness assessment framework and for the development of survey questionnaires for quantitative data collection.

6.0 Introduction

Collecting information, which researchers call data, is only the beginning of the research process (O'Connor and Gibson, 2003). The basic goal of qualitative data analysis is understanding the search for coherence and order (Kaplan and Maxwell, 2005). This understanding, which advances the researcher's knowledge of interpretation, provides answers to the fundamental questions of the entire research study. This is done through an iterative process that starts by developing an initial understanding of the setting and perspectives of the people being studied (Kaplan and Maxwell, 2005). The iterative process occurs when the analyst goes back and forth in the data with the intention of establishing links between the data and research questions and objectives. There is no singularly appropriate way to conduct qualitative data analysis. However, general agreement exists that analysis is an ongoing, iterative process that beginning in the early stages of data collection and continuing throughout the study (Bradley et al., 2007, Kaplan and Maxwell, 2005).

There are two popular approaches to qualitative data analysis, namely: content and thematic analyses with considerable overlap between them in the context of methods and procedures (Silverman, 2013). These processes of data analysis in qualitative studies share a number of similarities. In both processes, the researcher is expected to transcribe the interview, and obtain the sense of the whole through reading the transcripts several times (Elo and Kyngäs, 2008, Braun and Clarke, 2006).

Thematic analysis is a method for categorizing, analyzing and reporting patterns (themes) within data as minimally organizes and describes a researcher's data set in (rich) detail (Braun and Clarke, 2006). The most conspicuous difference yet between the two has been the recommendation that on the one hand the thematic analysis researcher considers both latent and manifest content in data analysis. On the other hand, the content analyst is able to choose between manifest (developing categories) and latent contents (developing themes) before proceeding to the next stage of data analysis (Vaismoradi et al., 2013). The outcomes of this chapter were expected to be exploring existing constructs appropriately where applicable and to identify/develop a new set of measurement tools for the constructs. As a result, the thematic approach was found to be more appropriate for the analysis of this qualitative data in the sense that on the one hand themes will be serving as candidate constructs whereas on the other hand categories will be used as construct measurement instruments. The data was analyzed manually and using Nvivo 11 software.

To reinforce the thematic analysis and establish reliability, the researcher used NVivo software version 11 to repeat the process of organizing the data in a form of nodes. The purpose was to discover a computer program which could facilitate and offer flexibility that would complement the manual thematic analyzed of the qualitative data (Bringer et al., 2006). NVivo is a software package designed to support the analyses of qualitative data (Basit, 2003). Data from various interviews in word document format were imported into the NVivo software. The sought improved reliability was achieved by constantly referring back to the original transcripts and checking meaning across interviews using Nvivo search functions (Smith and Firth, 2011).

6.1 Participation

A total number of 13 out of the 36 invited participants participated in the interviews from relevant healthcare organizations and academic institutions (see Table 6.1 below). A prior appointment was made with each of the study participants. Where participants shared their offices with others, the interviews took place in other offices that were not in use within participants' respective work premises. The interviews lasted between 55mins and 1hour. One common characteristic of all respondents was that they had all in one way or the other directly been involved in IT/e-Health initiative/programs. IT managers, in particular are currently working on various IT projects in their respective hospitals, as a result first-hand information regarding the state of IT/e-Health in public hospitals in Ghana was expected. Following is a table summarizing demographics of participants. Following is the summary of distribution of participants in table 6.1

Table 6.1: Demographics of participants

	Distribution of sample	Location	Sample	No. Invited	No. Participated
1	20 e-Health projects	Accra	Project leaders/Managers	20	2
2	37 Military Hospital			1	1
3	NITA	Accra	Head of IT, Head of applications and Director General	3	1
4	eGovernment Ghana (MOC)	Accra	Coordinator	1	1
5	MOH	Accra	HIT coordinator	1	1
6	GHS	Accra	Head of IT, Administrative Manager	2	2
7	SPH (Dept of Health informatics)	UG	lecturers	3	1
8	NHIS	Accra	Director of information management	1	1
9	Korle Bu Teaching Hospital	Accra	Head of IT, Senior Admin officer	2	1
10	Komfo Anokyi Teaching Hospital	Kumasi	Head of IT, Senior Admin officer	2	2
			Total	**36**	**13**

6.1.1 Pilot study with Participants

The purpose of the pilot study was to make sure that participants not only had ideas about the content, but also to ensure its relevance. Thabane et al. (2010) noted that conducting a pilot prior to the main study could enhance the likelihood of success of the main study and potentially help streamline the main study process. This would enable the researcher to verify if any questions had the potential to make respondents feel uncomfortable. Prior to the interview sessions with participants, the researcher e-mailed the drafted interview guide/*aide memoire* to participants encouraging them to comment on the guide.

6.1.1.1 Results from the pilot study

A telephonic discussion on the drafted interview guide/*aide memoire* with six participants helped with further identifying and refining some portions of the *aide memoire*. For instance, one participant of the pilot study suggested the need for more managerial/leadership related issues. Another participant felt more attention should be paid to government-private collaboration or inter-healthcare organizations collaboration as those are currently important issues as well given that public hospitals in Ghanaian cities were more likely to be prepared than those in the rural places. Most participants flagged the need to concentrate if at all little on funding issues. These concerns were addressed in interview guide. For instance the researcher avoided any type of “leading questions” in the interview guide relating to finance and inter-healthcare collaborations. Instead keywords such as stakeholders were used in addressing the recommendations offered by participants of pilot study.

6.2 Actual one-on-one interview sessions

Prior to meeting with respondents for the actual interview a few e-mails and telephone calls were made to confirm the appointments. The researcher also made phone calls 30 minutes prior to the appointment time to confirm if participants were still available for the agreed time. In all cases agreed times were honored.

Prior to the commencement of the interview session, the researcher ensured all respondents had a hard copy of the interview guide e-mailed to them beforehand. The researcher then went through the interview guide document with each participant beginning with the participants’ consent form to make sure participants actually understood what it meant to participate in this research study, their rights and how the data was going to be collected from them. Furthermore, together with individual participants, the researcher perused the research synopsis and USQ’s data protection issues.

One eye-catching observation was that none of the IT managers at participating hospitals had an office allocated only to them. As a result, in most cases they would take the researcher to a vacant office in search of a quieter and more conducive environment for the interview to be conducted in, unlike their counterparts in other industries such as the banking and other corporate organizations, who have their own offices.

A second observation by the researcher was the expression of interest in the research by participants. Participants also commented on the relevance of the research in anticipation that the outcomes may have a positive impact on the need for developing countries, in particular, Ghana, to begin to view the importance of using IT to improve healthcare delivery. In all of the observations, the researcher maintained neutrality in order to avoid pre-emptying the outcome of the research as well as to minimize bias, particularly in the way participants answer questions.

Interviews were audio-recorded using an iPhone 6 and later transferred to a Mac Pro laptop for transcription. Questions asked were open-ended (see Appendix 5), which allowed respondents to explore and describe issues relating to IT adoption in public healthcare institutions in Ghana. Other observations of respondents were also recorded/written in a field notebook. Noticeable among them were actions that followed some particular answers – nodding, headshakes, laughter, and loud pronunciation of some words denoting emphasis as part of discourse.

The adoption of IT in healthcare is a delicate and complex organizational change process. The researcher transcribed each audio-recorded interview personally. Later the researcher went over the audio-recorded version and the transcribed data to ensure its accuracy. On average, it took approximately 20 hours to transcribe each interview in word format. The process of transcribing the audio-recorded interviews allowed the researcher to begin to familiarize himself with the transcribed data, which was followed by skim reading in order to continue with the data familiarization exercise and for better understanding of the variations among answers provided by study respondents.

Generally, during interviews, particularly for those that took place in participants' offices, there were interruptions, often knock on the office door, and participants would have to respond, and ask to be excused. On some other occasions, participants' mobile phones would ring. On all occasions, the researcher encouraged such participants to answer their phone calls whenever they felt the need to do so.

6.2 Qualitative data analysis

In this qualitative data analysis, the researcher moved from the collected qualitative data into some form of explanation and interpretation of the people and situations being researched. Therefore, the aim of this phase of the study was to bring out key categories or concepts and themes, which underlie the different study responses collected. In this research study, a mixture of qualitative methods of thematic analysis, incorporating both the data-driven inductive approach and the deductive template of codes approach outlined by (Crabtree and Miller, 1992), was adopted. This was because the researcher felt that the mixture of the inductive and deductive approaches had the potential to bring synergy to the whole data analysis process by allowing the principles of social phenomenology to be integral to the process of deductive thematic analysis, while allowing themes to emerge directly from the data (Crabtree and Miller, 1992) using inductive coding

Applied throughout the process of qualitative study, this interactivity is explained as the overarching principle of "goodness" (Tobin and Begley, 2004). The primary objective for the data collection was to represent the subjective viewpoint of senior IT managers and academics in the field of health informatics who shared their experiences and perceptions of the readiness of public hospitals to adopt HIT/e-Health.

In this research study the qualitative data analytical approach recommended by O'Connor and Gibson (2003) in which they outlined five well-defined steps towards analyzing qualitative data was adopted, because it provided a straight-forward approach to analyzing qualitative data. Table 6.2 below demonstrates this.

Table 6.2: Five-step data analysis

Step	Activity	Outcome
1	Organizing the data	Orderly displayed/arranged data
2	Finding and organizing ideas and concepts	Categories/codebook
3	Building over-arching themes in the data	Themes
4	Ensuring reliability and validity in data analysis	Validated/Confirmed findings and assurance of reliability
5	Finding possible and plausible explanations for the findings	Communicated findings and their implications (see Chapter 10)

Source: Adapted from O'Connor and Gibson (2003)

6.2.1 Organizing the data

To organize the data, the researcher read through each interview guide/*aide memoire*. This was followed by the researcher engrossing himself in the data in order to comprehend its meaning in its entirety, an important first step in the analysis of qualitative data (Bradley et al., 2007). As recommended by O'Connor and Gibson (2003), the data was organized in a way that made it easy to peruse, and that allowed the researcher to go through each topic to pick out concepts and themes. In doing this all transcribed data was organized into a table according to the interview guide/*aide memoire*, which corresponded to answers provided by respondents labeled alphabetically: R1, R2, R3, R4,... R13. This helped to identify and differentiate between the questions the researcher was trying to answer. In effect, this way of organizing the data allowed the researcher to look at the responses to each topic and specific questions individually in order to make it easier to pick out concepts and themes. The researcher made notes on ideas emanating from the arranged transcribed interview responses and listed recurring words, picked out concepts and themes from various responses on a particular topic and/or constructs. Refer to Table 6.3 below for an example.

Table 6.3: A sample of organized data table

Research Question/topic	**Participants/Respondents**	**List of ideas/codes**
Q1. What in your view/experience should constitute planning for the adoption of information technology (IT) in public hospitals in Ghana?	**"***Well extending our current NHIS to include capturing detailed patient health information as needs proper planning, which requires a little bit more coordination and understanding; there must be a standard, national standard, there must be an architecture that will support all that. Those things may be on paper yes they may exist somewhere you may have something on paper, may be some enterprise architecture or some somewhat how a sector wide how e-Health system shd function. However, like I said, may be we have not been able to put our heads together as a nation to really get to that. For hospitals trying to implement these systems, I think it is important for them to rather have their planning documents that tells them how they will go about such projects than rely on the national e-Health strategy. I also think that if we can learn from all of those small, small projects around and establish some sort of proof that e-Health can help improve our healthcare delivery, then that may be the starting point. Because if you look at the national e-Health strategy, it lacks specific in terms of the objectives to be achieved. So hospitals may not be able to rely on it*." **R1**	• Planning • Need for coordination; • interoperability and national standards with supporting architecture; • set policies; • bring various stakeholders together; • difficulty with IT implementation in Ghana in the wake of limited HR; lack of structure to support IT personnel; • Proof that e-Health can help improve healthcare • National e-Health strategy too generic. • Hospital HIT implementation plan
	"Management realised data is available but scattered. We did something called healthcare knowledge management and I got to know that as a person working here, there is data everywhere but segregated. How do we put it together? That was the situation analysis or our need assessment he did on health information. Management realised data is available but scattered. We did something called healthcare knowledge management and I got to know that as a person working here, there is data everywhere but segregated. How do we put it	• Strategic plan; • situation analysis/need assessment; • determine deliverables/outcome; • good leadership is important • knowledge in both medicine and IT is key • bad leadership makes moving forward difficult • Evidence of success • Application of knowledge and leadership

*together? That was the situation analysis he did on health information. The hospital management then came up with a strategic plan to guide the implementation all our IT projects. One important thing I noticed now compared with what we were doing before is that our current CEO has deep knowledge about both medicine and IT and that is what we need to get this done right. Previously we used consultants, but right now, we are doing everything from the scratch ourselves. What I'm saying is that if you have problem with leadership, then things can be difficult going forward". But we have successfully implemented some of these systems at the polyclinic and the maternity ward. So we can now move on with the other departments. Going forward, he then put in something we called health informatics unit. So the informatics unit brought the biostatistics department, the IT, and Telecommunication together to form the health informatics. The idea is that telecommunication will create communication among departments; IT will deliver applications, which are needed, deal with technical feasibility, types of technologies needed and their suitability to our work, then the biostatics will now use it to collect data and analyse it for usage. So, we for e.g. had 3 desired outcomes. 1. Data timeliness, that all operations are available in real time. 2. Data integrity that the data is available is accurate and reliable. 3. Data usage, if the data is accurate and reliable then you can use it for decision-making." This is like the technical side of the whole project with all the implementation stuff. I mean this is where we have plans for the implementation, decisions regarding going forward, updates of our project implementation plan in our progress reports, and many others."***R2**

- Technical feasibility
- Technology types and selection
- Technology suitability
- Data timeliness (service quality)
- Decision making (service quality)
- Service delivery technologies
- Needs of organizations and technology selection
- Implementation plan
- Updates plans

"When you think of any IT in terms of our hospitals, the key things I will say at the moment is a proper planning document setting the course for a road map for the implementation of any kind of e-Health. I also think they need to do this in knowing that policy, infrastructure and human resource (HR) are issues at the national level. For me, I think those are the three keys areas, because definitely you need the infrastructure in terms of the; HR/skills to manage the ongoing initiatives/programs. As you know, in Ghana, we have challenge of shortage of doctors and long waiting queues of patients. So we have to begin thinking about the kind of services which can be offered through which kind of e-Health technology to meet the needs of both hospitals and the public. But this will be up to individual hospitals to do that knowing that they have partners or other serving points to help them execute such projects. Because we have these health professionals, different cadres with different levels of computer literacy. So you cannot think of health information technology (HIT) without making them (care providers) key components. I mean we have to engage them in order to understand their needs and fears. So there is some element of change management. The other thing I mentioned was the policy. Because we have the Ghana Health Services (GHS) and the Ministry of Health (MoH). Policy is supposed to be made by the MoH and implemented by the GHS. So if there is a policy framework then everybody knows exactly what is happening and then how anything or any adoption of IT; what the progression will be like, what the country is looking out for; the mission, and all those things can be put in place. So for me these are the three most important things". **R3**	• Planning • Policy as guide • IT infrastructure • Human resource • Shortage of doctors • Identification of healthcare services to be delivered using telemedicine • Identification of partners • Needs identification and fears • Change management • Policy framework • Making care providers a key component • Hospitals to implement HIT to consider infrastructure, policy and workforce availability/readiness • Examination of technologies • Stakeholder involvement • Need assessment

Source: Developed for this study

6.2.2 Coding and Categorizing Ideas and Concepts

"Category" is the primary product of the analytical process. It has a descriptive identity and is mainly used at the beginning of the theme development process to classify findings, which helps with the provision of details for analytical theme development (Vaismoradi et al., 2016). To do this, the researcher developed categories out of the identified ideas and concepts at the beginning of the data analysis process to enter the abstraction process.

To find and organize concepts, the researcher firstly focused on the primary message content from the various responses for one particular question. This activity led the researcher to encoding, which organizes the data to identify and develop associated themes from them (Fereday and Muir-Cochrane, 2006). The researcher noticed that specific words or related ideas kept coming up. The researcher then kept a list of these as the different responses were read through and evaluated the attitudes of the respondents towards the responses and the degree to which the individual respondents were representing actual versus hypothetical experience. The coding method encompassed recognizing key instances and coding them**.** It is an activity which is conducted prior to interpretation and captures the qualitative richness of the phenomenon under investigation (Boyatzis, 1998). The researcher observed those important movements and reported them in the field notebook. See Table 6.4 for a summary of the categorized ideas and concepts

During the coding of respondents' perceptions, attitudes and feelings about certain issues/state of HIT adoption in Ghana, in particular public hospitals were categorized by the words they used to express themselves. These made the researcher pay more attention to whether the message of the content was meant to represent individual or group-shared ideas. For example: "*absence of IT governance*" [aloud] R6. The researcher also identified some situations called "rich points", when some respondents seemed to have gone in a new or unexpected direction. For instance, R1 used the phrase

> "*…microcosm of the whole national situation*". *So what I'm saying here applies to Agriculture, education, it applies to every sector. So I don't know if it is a disease*" R1.

The use of "*microcosm*" denoted that the issue being referred to was common to all public sectors in all over Ghana.

6.2.3 Exposition of codes/categories for theme development.

6.2.3.1 Planning

Many HIT procurements are based on presumed benefits, which are often poorly specified. It is therefore important to assess if, and to what extent, existing/new health information technology could support these strategic goals and whether other approaches may also need to be considered (Cresswell et al., 2013). Planning in this research study is defined as the identification of the need for HIT and to establish the necessary structures to successfully implement the relevant HIT technology. The following concepts were found in the data to be relating to planning towards the implementation of HIT in public hospitals in Ghana.

6.2.3.1.1 Strategic planning

> *"Somewhere in 2011 we saw the need to have an e-Health strategy and so it was done" R4.*

Like any other initiative, participants unanimously agreed that before attempting to develop any HIT program, be it EMR, EHR, and e-Prescription, it is imperative for a healthcare organization to have a concise plan, which should be motivated by the vision of the hospital.

> *"Therefore, we for example, had three desired outcomes. 1. Data timeliness, that all operations are available in real time. 2. Data integrity, that the data available is accurate and reliable. 3. Data usage, if the data is accurate and reliable then you can use it for decision-making." R3*

According to participants, the strategic plan serves as a management guide into the future progress of the said HIT program as one participant relates:

> "*The hospital management came up with an IT strategic outcome framework (SOF) to guide the implementation of HIT related projects". R3*

According to respondents, it appears that the majority of healthcare facilities in Ghana have some sort of HIT plan in place. For HIT strategic plans to be effective, they have to be put together in such a way that they are executable. Given the understanding that all respondents agreed on this crucial piece of strategic plan when it comes to planning for HIT implementation, critics will be pardoned if they ask why public hospitals in Ghana have not seen many successes with HIT implementation in Ghana.

Despite it being a slow progress, however, some healthcare institutions are actually executing their plans.

> *"Going forward, management then put in something we called health informatics unit as the beginning of the implementation of the strategic plans for the introduction of HIT. So the informatics unit brought the biostatistics department, the IT, and Telecommunication together to form the health informatics. The idea was that telecommunication will create communication among departments; IT will deliver applications, which are needed, then the biostatics will now use it to collect data and analyse it for usage"R3.*

With the acknowledgement for the need for a strategic plan, comes the challenges of implementing the planned strategy. As with many developing countries, the difficulty of executing the various components of plans is a well-known predicament amongst strategic planners and implementers.

> *"The only difference is that it's been extremely difficult to implement it because it comes with some commitment, some cost, and people are able to move around it and do one or two implementations especially when it favours some people"R4.*

As with many other healthcare organizations in developing countries, responses from respondents clearly showed the gap between planning and execution. Analysis of some HIT strategic plans show fractures in the context of differences between plans and the reality on the ground. For instance, many health care institutions have objectives that are too general to achieve. In order words, the set objectives are not specific enough. In other cases, the objectives fall far outside those of the Ministry of Health (MoH) Ghana or Ghana Health Services (GHS).

6.2.3.1.2 Needs assessment

Needs assessment is not a new concept in the literature of HIT readiness assessment (Chipps and Mars, 2012, Khoja et al., 2007a, Kgasi and Kalema, 2014, Li et al., 2010, Scharwz et al., 2014). In the data collected and analysed this concept was confirmed. The majority of respondents were concerned about the presence of a shoestring budget allocation of funds for healthcare and in particular, for IT in hospitals. It also appears that IT has not been fully acknowledged as an important tool capable of bringing down the cost of healthcare delivery while improving access and quality. Given all of these setbacks, the analysis of responses suggests the need to get it right first time around, when HIT implementers request funds to undertake HIT initiatives. In planning for e-Health implementation, a needs assessment/identification of needs was seen to the first critical step towards building an effective and sustainable HIT program. On this note, R13 asserts

> "*…that plan must take care of the assessment of what we need. We have to make sure that out of the plan we are able to identify what services we want to deliver using the telemedicine or whatever technology it will be" R13.*

A needs assessment, while not a guarantee, can improve HIT implementation success by helping in identifying and developing a value driven HIT program.

> "*…we have to make sure we get it right because we do not usually have enough funds" R7.*

It appears from the respondents that the biggest challenge in the case of public hospitals in Ghana was the inability to conduct needs assessments effectively.

> "*…so what we did was to give out need assessment forms to every doctor and nurses as well as other departments to fill in. In the forms, they have to state what they do and the difficulties they need to get rid of. Therefore, we took our time and took data based on the requirements that each and every department gave us so we called that one master data collection towards our assessment of needs of stakeholders of the entire hospital" R3.*

Furthermore, the analysis found that healthcare access and quality were eroding within public healthcare services in Ghana and in most developing countries. As a result, many countries around the world including developing countries and in particular Ghana, were making sweeping health care reforms including universal access to health care

> "*The national health insurance scheme (NHIS) was introduced to give residents of Ghana access to affordable healthcare services*" *R1.*

The introduction of the NHIS has, however, not only increased access to healthcare, but has also in part resulted in escalating costs as one HIT manager relates

> *"The GHS is looking at cost containment. So, if you look at our situation that is what we need to do now except that to implement it is a bit difficult but with ...people can access service and because probably a doctor didn't give you injection an old lady may decide to visit the next doctor and access the same service" R4.*

It was apparent in the data gathered that the need for needs assessment was multi-faceted. Notable reasons included looking into ways of increasing healthcare accessibility and data seamlessness, reducing HIT project failures, increasing HIT projects' success rates, and initiating value driven projects for wider adoption/acceptance while reducing healthcare expenditure.

6.2.3.1.3 Identified/selected healthcare services

This concept summarized the findings from respondents who argued that in planning for any HIT technology, in particular telemedicine, mHealth, and other types of e-Health services, there was need for the identification and selection of services that could best be improved with appropriate HIT systems.

> *"…in order for us to make good use of the little money allocated to IT, we make sure that we initiating programs that are most needed… I mean we have to look at the services that mHealth or telemedicine can best serve" R13.*

In the context of Ghana as a developing country, respondents suggested systems that allowed healthcare providers to be able to instantly access and use patient information.

For the poor nature of transport and the postal system and other socio-economic constraints, mHealth/PDAs will allow field health workers to transmit images of affected areas of patients for example to specialists, send SMS via mobile phones to patients as reminders for appointments and medication adherence.

> *"…we wanted to also look at the benefits of e-Health in terms of lack of specialists and how we can use e-Health to support. There are specialists at Korle Bu Zebila hospital or Wa does not have so how do we use e-Health so that they can talk and do procedures" R9.*

Responses such as this confirms a struggle by most healthcare institutions in comping up with viable HIT programs that have specific targeted objectives.

6.2.3.1.4 Knowledgeable key personnel

This concept confirms the continuous struggle for a c-suit individual with expertise capable of successfully planning and implementing HIT initiatives. A few decades ago, the fields of IT and Health were parallel to each other. Over time and in recent years in particular, their relationship has been one of convergence. Unlike other industries where IT adoptions have been easy, in healthcare, due to people's lives being at stake, use of IT continue to expand but with caution as one mistake could cost many lives. From the data gathered, the lack of workforce with the requisite knowledge to lead most HIT in Ghana was clear. This was further exacerbated by lacking structures to employing IT personnel in the healthcare as the MoH concentrates more on employing clinicians rather than adding one supporting IT personnel to its payroll.

"*When it comes to human resource, the doctors and nurses are the preference. It is an element of priority. MoC came up with scheme of services for IT personnel but could not implement it" R6*

"*The GHS for an example does not even have a structure for supporting IT personnel within their set up. It tells you the recognition that IT is given" R1*

The respondents painted a clear picture of how IT is being perceived in the healthcare environment in Ghana. It is not just the lack of skilled personnel, but also the inability of MoH to retain their IT service personnel, which introduces another quagmire. There is a long way to go before IT fully establishes itself as an important *aide* of the vision of the healthcare industry to increase accessibility, improve quality while decreasing costs.

6.2.3.1.5 Evidence of HIT effectiveness

This has also been perceived as one of the important themes in the context of planning for HIT implementation. Many respondents agreed that there are strong evidence suggesting that HIT will be effective when a proper need assessment was conducted leading to a value driven HIT initiative. They referred to known projects including Sene PDA, and MVP as examples of the success stories evidencing HIT effectiveness in Ghana.

"…the telemedicine project by MVP is another successful project, which is in progress and is about to be scaled up to other districts outside Amansie West. Maternal and infant mortality in the district has seen a tremendous decline in recent years. So it's still ongoing" R3

In the data, respondents were also cautious of not implying that the successful stories should be taken as basis for future implementation of similar or related projects. They were of the view that for every HIT there will also be the need for any needed assessment to be conducted. The analysis suggested respondents' strong opinions on the need for individual healthcare services to be given the necessary consideration and consultations with relevant stakeholders to verify the value, which would be driving that particular program.

6.2.3.1.6 HIT national coordinating office

There are many silos HIT projects in Ghana in partnership with the Ghana MoH and GHS. These projects, however, have no shared objectives with those of the MoH and GHS. As a result, many respondents spoke of the need for an HIT national coordinating office. In this regard, R1 asserted that:

"*People have attempted to introduce small, small systems to see how they work. May be all the lessons learned should be put together. There is pilot here, pilot there, pilot there a lot, a lot has been written. So, what have we learnt in all these? Is there anybody looking to put these* *together and see, synthesise it and see"? However, if there is a national coordinating office, which knows about all these projects that would have made a big difference, there is little collaboration" R1.*

On the issue of lack of collaboration or involvement, R7 asserts:

"*The other challenge is that the National Information Technology Agency (NITA) does not involve us as stakeholders in their projects and does not conduct needs assessment with us. For instance, they are having a project whereby they wanted to create a data centre for the whole of Ghana to link all government agencies. We were there when someone from NITA came with a letter from NITA to install a network device, so I sent him to the server room; he couldn't because he did not know our network" R7.*

A national HIT coordinating office will play an important role in making sure related projects are managed well as programs to achieve expected shared outcomes.

"Maybe we need an office that will actually be coordinating these things within the country and then seeing who is doing what; what are the results, what are the benefits; are they sustainable?" R3

The supposed national coordinating body, NITA seemed to only be an implementing agency, but needs to do more to bring all related projects under its control so that lessons learned from various projects can be used as a leverage for better development of relevant HIT projects and their implementations.

6.2.3.1.7 IT governance

"To have proper implementation, people need to understand what we have, their role, the governance structure, people should be involved. You can't bypass any group of people so there are issues with IT governance, because the framework is there" R4.

The starting point of governance in IT is the definition of an operational structure, which outlines roles and responsibilities of ongoing projects. In Ghana, in most public hospitals, there are only IT managers who report directly to the CEOs. However, most do not attend heads of departments meetings. The implication is that IT reports/cases are not presented as part of the CEO/departments' head meetings as R7 relates

"*As the IT manager, and according to our organizational structure, I report directly to the CEO. However, I do not attend the heads/directors' meetings. As a result, I report to the head of administration because the CEO does not reply to me. Hence the agenda for their meetings do not feature IT" R7.*

It still goes back to the lack of recognition of the potential of IT used in the context of healthcare as asserted by R1 above to enable an affected change in the delivery of health care, making it safer, more effective, and more efficient. The general sense (with the exception of a few) was that most CEOs in public hospitals have not yet acknowledged the potential of IT to improving healthcare delivery.

Figure 6.1: Nvivo text search query results for planning

Source: Nvivo output

6.2.3.2 Engagement and buy-ins

The following concepts were found to be relating to awareness creation and stakeholder buy-ins.

6.2.3.2.1 Involvement of stakeholders in the planning process

Most respondents were of the view that one of the first things to do when HITs are to be deployed was to inform end-users or beneficiaries about the system and its potential. This enabled them to begin interactions with stakeholders to understand their feelings about the systems so that they do not reject the system as one respondent relates:

"In canvasing for the support and acceptance of the systems we are currently deploying we started with stakeholder engagement, in which we went round and did presentations. So the awareness was created and many suggestions made. We effected the relevant suggestions and decided with stakeholders how the implementation will go. According to our timelines, the first phase of the project is due to go live with five facilities in April. You realised that during that period there was a lot engagement, buy-ins, and many joint activities. So we gained the user acceptance because ownership and relationships were established, unlike in the past"R6

According to the data gathered, there has been some level of improvement regarding creation of awareness and community involvement in the development of HIT programs over the last few years. This saw a lot of improvement in how healthcare institutions in Ghana now come up with current and on-going HIT initiatives. In most cases the engagement starts with the consultation with the first end-user healthcare providers, as evidenced from this assertion:

"*So, we took our time and took data based on the requirement that each and every department gave us so we called that one master data collection" R2*

In exploring the consequence of not involving beneficiary end-users and communities, some respondents conceded that some previous projects that did not involve some level of stakeholders faced numerous barriers and eventually fell through. One of the participants reminisced:

"*Unlike in the past, for example, the case of the new Dodowa hospital that was just built and launched 2 years ago. As part of it, there was EMR automation system. They brought in a system from off-the-shelve, which conflicted with workflows and did not integrate with legacy systems such as the DHIMS so it was rejected" R6*

Rejection of HIT systems, as in the Dodowa Hospital example above, will have far reaching consequences in determining how well healthcare delivery in public health facilities thrives on the implementation of HIT to opt for an improved, affordable and quality healthcare for the ordinary Ghanaian relying on the public healthcare facility for better health.

6.2.3.2.2 Feedback about e-Health initiatives

In analyzing the data, it was found that the issue of gathering information about what primary stakeholders think about imminent or ongoing projects was crucial. In this context participants explained that feedback from stakeholders was relevant in improving HIT projects:

> "*We don't use the systems. Primarily, these systems are meant for them and we are only making sure that the systems are deployed and functioning. And so, we want to listen to them so we can help them*" *R9*

With the realization that HIT systems should be customer-centered (providers and receivers), the question of whether consumers would be ready to pay for improved serves was also was noticed:

> "*We do not only have to assess the kind of services that need to be delivered via e-Health, but also the need to find out if consumers will be in a position to pay for any additional fees when the needs arise. Maintaining systems and getting them functioning all the time is expensive…*" *R13*

> *…financial position, awareness and ability to afford the increase in quality of service…R7*

It was further observed in the data that in as much as HIT seems to have potential to improve healthcare services, it will not come without cost. For instance, mHealth would require all consumers to have access to mobile phones. Depending on the kind of services being offered, in some cases consumers would have to be using smart phones with Internet access. Participants deemed that stakeholder feedback would be relevant if any HIT was to have overwhelming patronage and sustainability. Data gathered therefore opens up the discussion on the dichotomy of the potential of HIT to improve healthcare delivery and its sustainability, particularly in the context of developing countries.

6.2.3.2.3 Identification of potential collaborators

The issue of potential collaborators was evident in data, given that e-Health may apply and share health information electronically. Therefore, several respondents discussed the importance of healthcare facilities (ranging from referral hospitals to health kiosks) being able to collaborate in sending and receiving information about consumers and other relevant medical information and updates. In discovering the implications of not having the right partner healthcare facilities, data analyzed suggests that the current challenge was finding other healthcare facilities that do have the required infrastructure in order for electronic information to be shared or exchanged. In some cases, according to data collected, while every effort was being made to make sure there would be as much partnership as possible throughout the available levels of healthcare – primary, secondary and tertiary, most of the primary healthcare facilities (especially those in the rural areas) lacked basic infrastructural requirements including computers, let alone Internet access. Computers in those facilities are mostly used for secretarial/administrative purposes.

> *"…most of those hospitals never even had computers before. The computers they had were used for secretarial purposes" R8*

> *"…a large proportion of our populace is still rural and the facilities are not that developed in these settings to really support e-Health. So we have to prepare them for these technologies" R1*

It was clear in the data that the issue of HIT success and sustainability was far beyond individual healthcare organizations' readiness. It would take, however, a confederation of healthcare facilities to really get e-Health up and running to the benefit of those who need it the most. The findings from this study further explore in detail the opportunities to improve healthcare delivery, juxtaposing complexities that exist in HIT adoption in developing countries and the degree of high failure and sustainability rates of HIT in third world countries.

6.2.3.2.4 Support of board of directors' and management/leadership

For any change or major interruption to be successfully established, the Board of Directors (BoD)/management leadership team should be aware and happy to approve or support it. In the same context, for HIT to successfully be deployed and sustained, the full backing of the BoD/management/leadership team in the healthcare organizations. The infant nature of HIT, tight budgets, the shortage of healthcare providers (doctors) and the nature of healthcare as a "life on the line" industry make the decision to procure computers over other fundamental healthcare items a very difficult and challenging one.

> "*…they had to get additional doctors to contain patients… that was their call, forget about e-Health, and forget about systems" R9*

These difficulties were evident in the data. Respondents agreed that HIT was important, however they also acknowledged the conundrum faced by BoDs in supporting their HIT ambitions. In the data, it appeared respondents contend that BoDs were always in support of IT systems for billing and revenue mobilizations more than for clinical purposes

> *"… the HAMS has so far helped in putting problems of revenue under control…as for that one no problem because it's for billing the patient" R7.*

The consensus from respondents (found in the data) epitomizes the ongoing battle for the acknowledgement of HIT. According to data analyzed, it appears that management/ leadership teams in public healthcare facilities in Ghana have a keen interest in HITs but believe that other more important issues need prior attention. It was evident, too, that the momentum for support from BoDs was rising, therefore perhaps more evidence of the effectiveness of HITs has to be established.

6.2.3.2.5 Identified internal/external champions

A large proportion of responses underscored the need for key people to go out and interact with interested groups and individuals. They related that identification of key people for every HIT was crucial in preparatory measures towards implementation. When asked further about a typical key person, respondents contend that key persons must be trustworthy individuals in leadership positions who could motivate the project and would be keen to stay dedicated to the initiative over a required period if not for the lifetime of the initiative. “The life time of the initiative” draws attention to the fact that most of our e-Health plans remain as projects, which implies that they may not be permanent or sustainable initiatives.

> *“In most cases, our champions have been healthcare providers who already have a relationship with the majority of their communities” R4.*

It appeared further in the data that for most respondents, effective and viable HIT projects call for champions who can devote their time and energy to the project, be prepared to promote the anticipated benefit, put energy into the project in the early stages and be involved in the preliminary planning process. A further analysis of data in this context suggests that champions in some cases actually conduct the needs assessment themselves/with their teams and on rare occasions even fund the initiatives:

> *“NITA was our champion and sponsor for the Korle Bu-Wa-Zebila project. They provided some routers and some computers at some point” R3.*

Therefore, not only are HIT champions important for the successful implementation of the projects, but also play a key role where necessary in funding the projects.

6.2.3.2.6 Establishing regular lines of communication

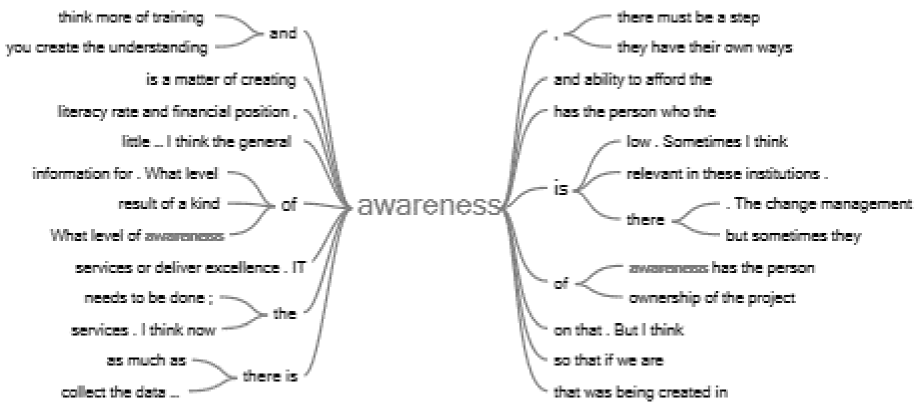
Communication emerged as one of the important aspects of engagement as part of HIT adoption preparations. In the data, it was found that to properly engage with stakeholders at all levels, regular communication lines must be established. Respondents suggested that their technical teams were the first points of contact for the majority of stakeholders particularly doctors and nurses. They did, however, admit that sponsors and senior managers would prefer to engage directly with themselves. Respondents were of the view that, in most cases, engagement with senior organizational management and other sponsoring organizations needed to be at managerial level where important information about initiatives were provided:

> "*When the CEO wants to see me, I know it's more than just a mere technical problem. They usually require information about progress being made for the whole project and that requires a lot including reports and if possible implementation plans*"*… But for the ground work and questions my boys are always running around solving the problems and reporting on issues. There is that kind of regular and easy communication with end-users, which I think is helping acceptance" R2*.

> *"One important thing we did was to create regular lines of communication so they were free to contact us for any questions" R6.*

According to the data analysed, the technical teams were the points of contacts for the end users. It was clear in the data that the ability of end-users to reach out to the technical team was seen to be critical towards allaying fears and restoring confidence towards acceptance and use of HIT systems.

Figure 6.2: Nvivo text search query results for Engagement and buy-ins



Source: Nvivo output

6.2.3.3 Change management

The following concepts were found to be relating to HIT awareness and buy-ins:

6.2.3.3.1 Technology selection and stakeholder consultation

From the data gathered, one of the key findings was the need for stakeholders, particularly healthcare providers, to be involved when it comes to deciding on which HIT technology will best serve the identified needs. According to respondents, deciding on HIT technology implies healthcare providers' ability to provide accurate information or describe what they do and the challenges therewith as a way of dealing with the culture of non-participation and the attitude of "can't use this system" by healthcare professionals. The decision to involve stakeholders including physicians is now being recognized amid many HIT failures and lack of patronage and support by healthcare organizations' management/leadership teams. Participants agreed that when stakeholders were involved in the selection process of the technology, it brings a sense of ownership and acceptance and above all support from leadership. Regarding this, R6 relates that:

> "*…they took it away and came back with their recommendations/modification and we modified it…before signing for the user acceptance. Management has to actually be convinced on the capabilities of the systems. You realize that during this period there have been a lot of change management because we have engaged them there is a lot of ownership and buy-ins from various leadership" R6*

Respondents did agree on the fact that management, as physicians are "notorious" when it comes to skepticism towards HITs, even though they were aware of the potential capabilities. The majority of respondents were of the view that for management/leadership teams, more still needs to be done in talking them into understanding and recognizing that HIT is a tool, which when properly implemented, could help improve healthcare delivery and improve revenue in the end. For healthcare providers, however, switching from manual record keeping methods to computers when recording patients' information, they do think the pressure brought about by poor doctor/patient ratios; systems reliability and sustainability were issues of concern. Participants also agreed that doctors were in a better position to explain clinical aspects of their work, which they wish to improve using HITs. When users were involved in the process of HIT initiative, issues of change become easier as most of them might have already been aware of what to expect.

6.2.3.3.2 Past successes with instituting HIT related initiatives

During the analysis of the data, most of the respondents spoke of the influence of past successes as an important "plus" in any attempt to convince clinicians and non-clinicians alike to begin to hope that they can easily support the cause for any future systems. The delicate nature of the healthcare environment does warrant a high success rate with past HIT to assure providers that they will be not interrupted when such systems were deployed:

> "*…to be able to refer to some of our successes in the past will mean that there will be no fears with future projects*" *R2*;

> *"…the telemedicine project by MVP is another successful project, which is in progress and is*

about to be scaled up to other districts outside Amansie West" R3.

Even though past successes do not guarantee future successes, they do provide some form of platform to begin the journey of organizational change matters in the healthcare environment. Furthermore, it was also clear in the data that there were many examples of past projects that respondents were confident to refer to as part of records of accomplishment. It was important to mention, however that most of these successful projects were sponsored and led by donor organizations who had control over how the projects were being managed.

One respondent, however, warned:

> "*…we need to make sure that we do not dwell so much on our past successes. Because, here in the hospital the situation is different and even the patients are also different. Patients in the rural small communities may be different from those in the cities. Also, doctors practicing in rural communities were more likely to accept most electronic health record as that may help them in reaching out to other doctors and preventing patients travelling to cities for referral purposes" R7.*

With the debate over past success, one common element stood out clearly in the data, the need to always treat each project differently. A large proportion of participants think that the IT industry is a fast changing one compared with other industries. This makes the successful management of IT projects in developing countries comparatively more difficult, as they mostly lag behind their developed counterparts.

6.2.3.3.3 Availability of change leaders

The impact of a lack of attention to change management can have devastating consequences on the outcome of HIT implementation. It was evident in the data that change management did not receive attention from HIT implementers in Ghana:

> *"We don't see change to be important when we are doing these things but they do really affect us" R13*

> *… We did a pilot and at the end of the day we realized that… you see implementations in the advanced countries and here [Ghana] are not the same…so there were some lessons learned and that is one of the reasons why I think the change management is key but the availability of change leaders is even more important" R4*

Most respondents spent more time contrasting issues of change in the context of developed and developing countries. The focus of the contrast was tied to the fact that in developing countries little attention is paid to change management as an important element of simple HIT related initiatives as e-Claims. Data analyzed seemed to be suggesting that the need for change leaders was gaining momentum among HIT related projects, if they were to be accepted by end-users. This was especially true for healthcare providers:

> "*…you know they have a way of telling you that they are not interested in it because they will not use it even if it's good…*" *R2*.

The realization of the complexities involved in HIT deployment implied that change leaders would henceforth be an integral part of HIT projects in Ghana and hopefully other developing countries.

6.2.3.3.4 Availability of multi-layer change teams

From political, socioeconomic and cultural viewpoints, Ghana is a very dynamic country. This vibrancy was reflected in the responses of participants as they aimed to show how successful change management should be carried out in the healthcare environment. When exploring the effects of the multicultural nature of Ghanaian society in the context of change management, participants contend that blanket decisions must not be made when it comes to effecting change. Change processes must be considered in various layers. Their responses seemed to imply that team representation must be made available at all the different stakeholder levels considered relevant for the implementation of HIT. For instance, for healthcare providers, there had to be some agents who understand the nature of the roles of healthcare providers. At the community level, there have to be community change teams and so on and so forth:

> "*What we are doing now is to make sure we get representatives among all the stakeholders we are working with. Even at the "Organization A" we do have someone we work with, at NITA we also have someone we can always talk to concerning our progress and next lines of actions"*R8.

> "*At "HB", I have this guy we invite to our meetings. In Takoradi, and all of our sites, we have different people. Sometimes we use church leaders to promote our projects" R13*.

In effect, multi-layer change teams, were relevant according to the data because there exist stakeholder dynamics. They are complex – being the result of the collaboration of many factors including culture, structure and personalities. It was also apparent in the data that for any HIT to be successful, change workshops aimed at addressing fears and resistance were inevitable. These workshops must be ongoing to make sure that continuous difficulties causing users of implemented systems to give in must be addressed.

6.2.3.3.5 Availability of system implementation plan with clear anticipated changes

Another important characteristic of change that emerged from the data was the need for HIT implementing leaders to ensure that information concerning systems being implemented were well communicated to all immediate stakeholders. These included clear or unambiguous timetables, anticipated outcomes and the potential impact on current workflow/structure:

> "*What we actually did was to inform the doctors and the nurses when our teams come around, their names, what they will be helping them with and all that…" R5.*

From the data, it is understood that, with clear advance information available to immediate stakeholders such as doctors and other administrative staff, a greater support base would be established in the context of less resistance. The context of the data suggests that most HITs are not new to physicians, however, a few concerns exist on the ground:

> "*A lot of them attend conferences so they are familiar with HITs but the problem here is whether our current infrastructure will allow the systems to work is what I think make them nervous*" *R9*

It appears that good and reliable ICT infrastructure will play a key role in changing the mindset of users. From data collected, there were elements of physicians' concerns regarding moments when systems may not be available (downtime), which becomes a physician's worst nightmare.

6.2.3.3.6 Feedback mechanism

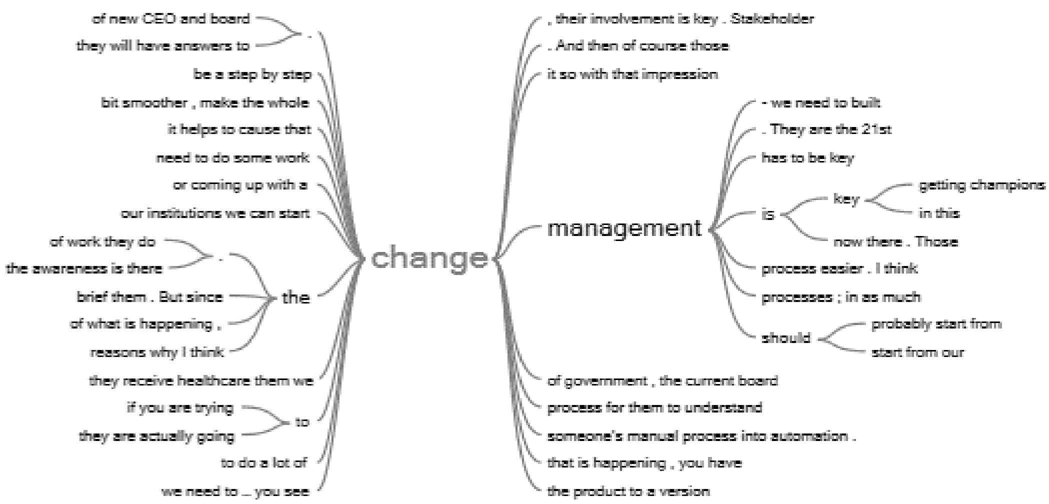
In the context of the data, participants elaborated on the fact that one way of assuring stakeholders of system effectiveness/user friendliness was to help them understand that their feedback matters and could help improve systems when implemented. Of great interest to system beneficiaries was how their complaints/queries were handled:

> "*Most of them don't want to get stuck in the middle of a system they are using and there won't be anyone to help them out. So, by creating a platform where they can always log complaints that can be attended even if it is not something that could be solved immediately*" *R10*.

In the data, there were elements indicating that to successfully deal with change issues, there was a need for two-way communication.

Communication plays a key role in change. Participants expressed opinions concerning the fact that establishing communication channels for people impacted by any change brought about by the implementation of any system, was crucial. In other words, a feedback mechanism is an interactive platform where stakeholders could be supported. An important part of change, as found in the data was ongoing support and that people at risk of being impacted must be assured that there would be support for them. Increasingly, as a starting point, “report an issue” e-mails were created as part of feedback mechanisms and emergency lines for technicians to be contacted whenever issues arose that needed an immediate response.

Figure 6.3: Nvivo text search query results for Change management



Source: Nvivo output

6.2.3.4 Value proposition

Rapid changes have occurred in technologies and their availability, as well as in the ways individuals and groups use and interface with these technologies (Higgs et al., 2014). e-health, enabled by ubiquitous computing and communication technologies, is facilitating a fundamental shift in the age old praxis of healthcare (Sneha and Straub, 2017). The shift, when embraced carefully, is capable of improving healthcare delivery in both developed and developing worlds. e-Health in its largest sense has been practised for many decades now—from basic telephony, through transmission of ECGs and images, to comprehensive records and even remote surgery (Scott and Mars, 2013). Resistance to Internet health treatments appears to be largely attitudinal, suggesting that enhancing community education and familiarity with such programs may be effective in improving perceptions and ultimately access (Handley et al., 2014). Information gathered from existing literature suggests that 75%

of the large systems that end up being used should be considered to be operating failures because they lacked real value to be derived by consumers. Information technology (IT)-based applications in healthcare, however, have existed for more than three decades (Rahimi and Vimarlund, 2007). The implication of such HIT systems will be lacking patronage, sustainability, and failure for that matter. For the purpose of this research study, value proposition is therefore the establishment of the anticipated benefits to be derived from HIT by healthcare organizations intending to implement it.

From the data gathered, value proposition in the context of this study could be defined as the use of IT to improve healthcare delivery by increasing accessibility, improving quality, saving lives while reducing the amount of time patients spend in hospitals through data sharing.

For HIT initiatives to be sustainable, they must have value which appeals to healthcare providers and the public. Data analysed suggests that for HIT initiatives to be valuable, the implementing team must ensure that HIT aligns with the healthcare organizations' mission/vision and be able to serve the designated client population, which in this study were healthcare providers and patients alike. In this context respondents elaborated that public healthcare facilities in Ghana were keen to make sure they deliver efficient healthcare, notwithstanding the challenges of doctor shortages and a lack of other resources. It was evident from the data that in initiating any HIT, the ability of the technology to enable reliable diagnosis whilst reducing care cost was paramount. In this context, one respondent asserts:

> *"If you have a good HIT system in place, every single detail that is dealt with or about the patient in any hospital in this country could easily be requested/known anywhere. You realise that some come here in the morning until late and travelling from far. Maybe they could not find their files at first or sometimes they may not need to come here at all" R8.*

It was clear in the data that "patient data" was one key element in the whole care process. According to participants, when information about patients is readily available, it would undoubtedly improve healthcare services by cutting down time wasting and increasing the number of patients to be served at any given time. According to data analysed, respondents were also of the view that having data stored electronically was going to help in protecting clients' data from being accessed/used by unauthorised persons. The majority of the respondents were swift in acknowledging that the current "patient physical folder" system was in many ways unintentionally breaching patients' information protection.

Relating to HIT supporting healthcare clinical goals and philosophies of care delivery in accordance with data analysed, participants were interested in finding HIT technologies with the potential to complement their face-to-face clinical activities. In exploring what clinical goals they wished HITs to support, most respondents agreed that those HITs with functions that allow electronic prescription, electronic diagnosis of patients in remote areas and sharing of clinical information were pivotal, especially for doctors in rural areas in order to get support with diagnosis. Furthermore, respondents believed being able to serve clients from remote locations would reduce pressure on healthcare organizations' resources, reduce travel time for clients while increasing access to healthcare:

> *"Our main goal is to reduce travelling while increasing access to healthcare for everyone. Imagine people travelling from the northern region to here [Kumasi]. Why not having their information sent to us including photos, X-rays and those stuff" R12.*

While these value propositions seemed to be known, it was critical to understand the context in which some of the assertions were made. Outside the office of the IT manager, a foyer on the ground floor welcomed patients and relatives. Some had come from far northern Ghana and were not sure when they would be treated. The reality of the need for HIT in the context of clinical purposes as per the visions of the IT managers with hospital management leadership, far outweighed the expectations from the HITs.

To successfully implement HITs, respondents were frank about the lack of supporting structures relating to issues of whether other healthcare facilities were ready to implement similar technologies and which healthcare providers were licenced and trained to be able to utilise such services if they were in place:

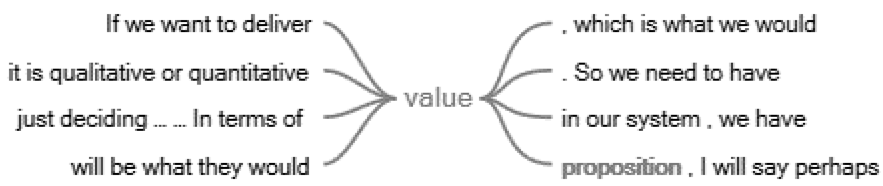
> "*We also even bear that in spite of even the rural-urban migration large proportion of our populace is still rural and the facilities are not that developed in these settings to really support e-Health*." *R1*

IT was apparent in the data that a mixed feeling about HIT implementation was present, especially the referral system. For the referral systems to work, there have to be collaborating healthcare facilities which are equipped with identical or similar systems. It was clear from the data that achieving the status of a functional e-Health system, more was needed to be done regarding technological and human resources respectively. The effect of the "*informal* *economy" R1* was present while exploring the issue of referral systems between tertiary or teaching, secondary and primary/community/polyclinics healthcare facilities. The underdeveloped nature of Ghana involves grouped populace according to cultures, making cultural responsiveness an important element to be considered when getting ready for HIT implementation. On this note, respondents believed that the way people live was an important thing to consider:

"Some people have not been to hospital for most part of their lives. They believe in herbs and other traditional medicines. So, if you want to introduce them to these technologies, you have to take your time to educate them" R7.

That said, in the data, respondents were sensitive about cultural issues and agreed that people's culture must be respected with regard to the introduction of technologies.

Figure 6.4: Nvivo text search query results for Value proposition



Source: Nvivo output

6.2.3.5 Technology infrastructure, system implementation and quality assurance

Technology readiness was explored in order to gain an understanding of issues that were supporting e-Health readiness and those that were impeding any progress of e-Health. Technology, system implementation and quality assurance in this research study are the requisite elements of technological infrastructure (hardware and software) and network facilities necessary for developing and operating an HIT system successfully.

Participants offered views on the technological atmosphere in Ghana from their perspectives. According to data gathered, the majority of participants perceive that public hospitals intending to implement/adopt HIT could do so successful, especially those in the cities given that ICT infrastructure in Ghana has improved over the last decades, thanks a to reformed telecommunication industry in the early ‘90s. This, according to respondents, could not be said of public hospitals in rural areas of Ghana. As noted by Yusif and Soar (2014), a lack of necessary technologies – technical incompatibilities; limited network coverage areas limit the number of health centres that could participate in some HIT projects including mHealh. According to data, there was an apparent need for thorough verification of issues around proper internet connection and network coverage as part of readiness prior to any HIT implementation commencement.

Respondents further confirmed this by pointing out that the majority of challenges in implementing e-Health are at an organizational level especially the complexities involved in systems adaptability and in making sure that technologies selected were a good fit for purpose.

> *“After collecting the data from the users, it was now time to gather information about relevant technologies, hardware and software because we were not developing it from scratch” R12*

A significant proportion of respondents also agreed that HIT implementation requires a blend of technology and management/planning in collaboration with stakeholders. They perceived that to successfully deploy any system, it was necessary to collaborate with stakeholders first:

> *“…so they suggested how the implementation was going to be done” R6.*

According to an insignificant number of participants, lessons were necessary if success was to be achieved with HIT system deployments in future. In particular, while participants agreed that most healthcare professionals were happy to participate in relevant user training sessions, they believe that there has to a structured training program.

> *“We train almost everyone who is concern with the system – doctors, nurses, cardiologist surgeon. I think we did a wrong deployment. If we did it in phase installation. If polyclinic, we train only them. But now we trained all of them, if they later forget who will be responsible?” R12*

According to data gathered, the difficulty in implementing HIT has remained a general challenge. In the data, the need for flexibility in HIT related vendor technologies was evident. The majority of participants agreed that technologies that can have technical modifications applied to them to suit the needs of implementing hospitals, were more relevant.

An important consideration arising when it comes to selecting technologies, according to participant was how different systems can interface with each other, particularly how new ones can be integrated and interfaced with legacy systems for the purpose of exchanging information. On this note respondents R6 and R10 relate that:

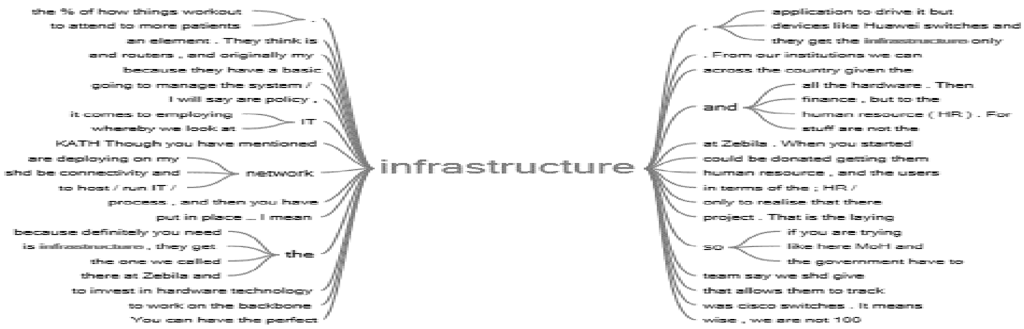
> *…it just didn't meet their requirement, in terms of information need, the quality of the service to be rendered, the integration into the DHIMS was not done. The workflow processes… meanwhile the whole hospital was built for complete automation…the workflow needs, integration/interoperability with other systems, clinical needs, which may be the workflow, because there is DHIMS and all of those were not considered" R6.*

> *"Interoperability issues and those technical things have to be seriously considered" R10*

> *"…integrate into the surveillance. There is no real-time surveillance information coming up from the DHIMS previously" R6.*

According to the data, the ability of systems to integrate and interface with others was a core requirement when considering vendor/off the shelf technologies. In all of these, participants were on the same page in acknowledging that it requires ingenuity to actually transform the healthcare from paper-based industry to that of an electronic industry with easy data sharing.

Figure 6.5: Nvivo text search query results for Technology



Source: Nvivo output

6.2.3.6 Workforce readiness

HIT is still evolving in developing countries, however, information technology is well known in such places. Therefore, from an initial point of view anyone with a good IT background ranging from programming to networking should be able to handle HIT problems. The healthcare industry is very different to other industries because of the intensity of the personal interactions (Carayon et al., 2011). This different nature of healthcare has brought about the fear of a shortage of skills in the workforce to handle IT in the healthcare industry. While this seems to be the issue across the globe, it appears to be more acute in developing countries. Workforce readiness therefore requires the availability and retention of qualify HIT personnel.

According to data gathered for this study, the perception on the shortage of skills seemed to be mixed. Respondents appear to suggest that there are alternative reasons other than the canonical "lack of trained personnel" in Ghana when it comes to IT. That was to suggest that the healthcare systems currently in place have no structures to accommodate IT personnel as healthcare providers:

> *"The GHS for an example doesn't even have structure for supporting IT personnel within their set up. It tells u the recognition that IT is given. People may pay lip service but on the ground we seem to lack the capacity to support" R1*

> *"Inability to retain trained personnel due to employment quota. Financial clearance from the finance ministry, which only comes once in every 2 years and when it comes it's just few." R2*

> *"The project is such that we are recommending two persons and getting it through GHS isn't easy." R9*

The majority of respondents were of the view that IT in health is not seen as a core part of the mandate of the Ghana health services. As such there were not current structures in place to allow the hiring of an IT workforce when necessary. This perception appears to be linked to the former view that IT is not recognised in the healthcare environment. While health departments are known to be among the largest consumers of taxpayers' funds, the risk of mitigating or lowering the expenditure through increased adoption and use of IT in health was perceived as not being taken.

A second group of participants confirmed what is largely known in literature, which is the actual shortage of skills. This group of participants perceived that there is a genuine lack of tertiary/graduate programmes to train personnel in specialties such e-Health and biomedical informatics, hence the shortage. In Ghana, there are only two universities currently offering courses in Masters Degrees in health informatics; the University of Ghana, Legon and the KNUST. Nonetheless, these problems have not dumb-founded individual healthcare facilities, which have recognised the potential of HIT, from see some HIT initiatives going live.

The last group, which is also relatively the smallest, see poor remuneration as one of the main reasons why the healthcare field cannot retain a skilled workforce. They point out that their counterparts were earning lucrative salaries in other industries, such as banking. Generally, in Ghana, there are claims that public servants are the worst paid. In the context of this research it goes without saying that while issues of remuneration were noted, the challenge was getting the workforce ready for the wider adoption and sustainability of HIT in public healthcare institutions in Ghana.

> *"…a local IT person or national service personnel[25] but here is case this is a project this is something we are going to transfer knowledge and tomorrow they are gone" R9.*

While there are no structures that could easily allow IT personnel to be hired, the other concern was whether they will stay after they are hired. In exploring this, respondents believe that when IT was recognised as an enabler of high quality healthcare, the issues of remuneration and retention of a skilled workforce would most likely be resolved. They also contend that getting ready to implement sustainable HIT systems implies that there is an adequate dedicated human resource, who were willing to implement and manage such systems. Furthermore, participants noted that in-house training, educational sessions and awareness creation were also necessary and that there was the need to generate comfortable conditions for implementing teams and users.

[25] New Ghanaian tertiary graduates placed in industry for one year

6.2.3.7 HIT policies, and practicing regulations

As with many e-Health readiness assessments, in this readiness assessment study, there was the need to investigate the readiness of healthcare institutions in the context of HIT regulations and policy as an important component. As an important part of the state of e-Health in Ghana all participants in Ghana emphasised the gaps in existing HIT policies and recommended the urgent need for such policies if public hospitals and Ghana for that matter were to succeed in adopting HIT into the main-stream healthcare environment.

The data gathered underscored the need for proper and reliable e-Health policy availability to serve as a guide for healthcare facilities intending to implement any electronic healthcare system. Participants blamed and critiqued the lack of any e-Health policy document, which they understand was hampering the ability of responsible agencies to conduct and coordinate the activities of various existing silos of HIT related projects in the country. Asked whether there was any policy document in any form, R6 dissented as did other respondents:

> *"No, we don't have policy. So we need to have a national policy for each e-Health technology such mHealth, Telemedicine, etc…even if it not national driven, individual hospitals coming up with their own have to consider the national one". R6.*

> *"There are no sufficient policies for the various types of e-Health that we have. mHealth for instance that has not specific policy document but there are projects of mHealth going on in the country" R10.*

> *"I also think they need to do this knowing that policy, infrastructure and human resource (HR) are issues at the national level" R3*

While it was apparent in the data there was not e-Health policy, one respondent disagreed referring to the 2010/11 drafted national e-Health strategy document as a policy:

> *"Somewhere in 2011 we saw the need to have an e-Health policy and so it was done". R4.*

The respondent, however, conceded that in reality it was difficult to implement the existing policy. Irrespective of how it was perceived, one thing was clear in the data gathered; the urgent need for a national HIT policy. Some aspects of the data seem to be suggesting that individual healthcare facilities were more likely to have some form of organizational e-Health guiding policy for their use:

"A number of them have gone paperless" R3

The disagreement over the existence of any policy is evidence of the state of HIT adoption at the national level.

6.2.3.8 Data availability and protection

In the data gathered, it was clear that one of the key reasons many public hospitals were going paperless was the need for quality and easily accessible data:

"Data timeliness, that all operations are available in real time. 2. Data integrity that the data is available is accurate and reliable. 3. Data usage, if the data is accurate and reliable then you can use it for decision-making" R2

Another reason for most hospitals exploring the possibility of successfully implementing HIT was for the protection of patient information from unauthorised persons:

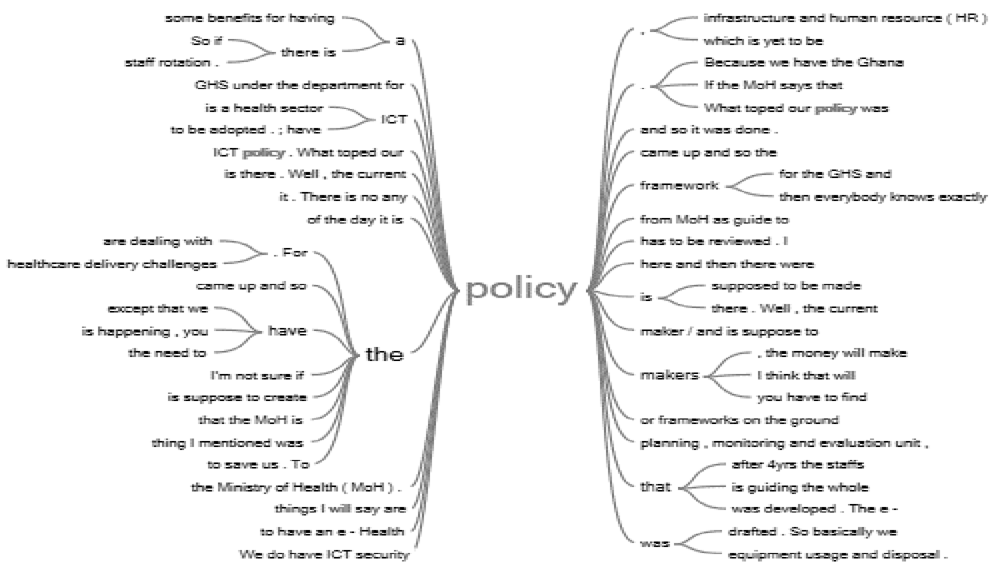
"If it is electronic, access levels will prevent unauthorised persons from accessing unwarranted patient information – on need to know basis. For instance, you are a laboratory technician. You need to work with samples, which are coded and not patient names. In health facilities, patients are to be referred to by their identity numbers. But what do we see here? Confidentiality is zero." R8.

An insignificant number of participants spoke passionately about the lack of regard for patient information, as many healthcare providers appear unconcerned about the integrity/confidentiality of patient data. This group of participants claim that the wrong people have easy access to patient information.

Whilst patient information seemed to be more secure electronically, there were other concerning issues relating to practitioner/patient use of HIT for healthcare delivery and healthcare consumption liabilities and the protection of patient information over the cyber world.

To all intents and purposes, HIT regulation and policy nonetheless does remain a challenge at the national level in Ghana. Previously in the literature, regulations and policy for e-Health have been found to be an unsolved challenged not only in developing countries but to a lesser extent in the developed world as well. For the purpose of this study, HIT regulations and policy are the relevant laws guiding the introduction and use of HIT for consumption.

Figure 6.6: Nvivo text search query results for Policy



Source: Nvivo output

6.2.3.9 HIT Funding and services reimbursement

The lack of funding for HIT initiatives has been well documented as one of the leading barriers to wider HIT adoption in developing countries. On some occasions, it was labelled as the reason e-Health projects barely make it beyond pilot phases. Funding HIT related projects in Ghana as with other developing countries relies heavily on external financial support in both money and expertise.

The data collected appears to be explaining the issue of finance in a subtler paradigm. It was clear in the data that the lack of finance was not fully responsible for low HIT adoption in Ghana, although a small proportion of the participants agreed that availability of funding was inevitable if e-Health initiatives were to be sustained. The majority of participants contend that the problem was more one of shared lack of recognition for the potential of IT to improve healthcare delivery by various ranks of leadership, with corruption and misplaced priorities by politicians also present, as one respondent relates.

> *"Is not about funding. Because people are always attracted to things that work. They are able to source funding for things that work. And even chase you with the funding". R1*

When asked to expand on "*things that work*", the respondent explained further that most people in authority, especially top government officials lack the understanding of the context of using ICT to improve healthcare delivery. The explanation relates back to the concept of the need for key knowledgeable people as an important ingredient in promoting a wider adoption of HIT among public healthcare institutions in Ghana. Participants who not do work in healthcare facilities believe IT heads in healthcare institutions need to have clear-cut policies when it comes to seeking leadership support, which includes funding:

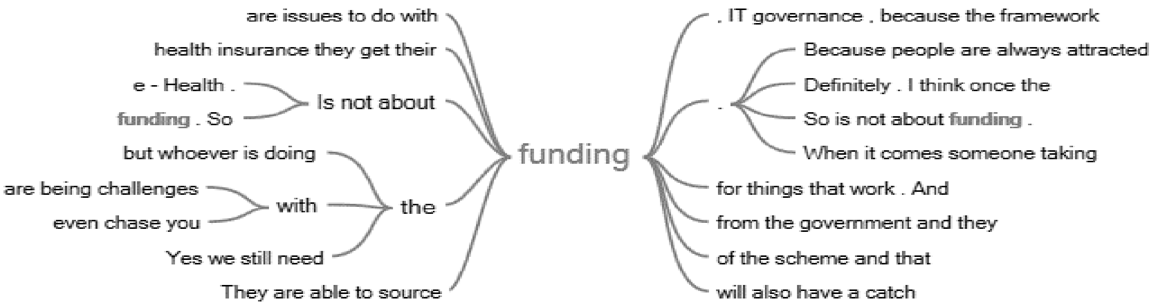
> *"Once you don't get the leaderships of every facility to understand the need to use technology to drive or prove to the person that in the long run… they might be looking at immediate benefits, which you will not see once you don't get the people to understand then releasing basic funds…" R4.*

> *"But leaders of these projects must also be able to demonstrate that they are aware of the operating cost which can be contained" R1*

It appeared though, that the dilemma of funding for HIT initiatives had a lot to do with availability of a qualified workforce. Perhaps most IT managers in public healthcare institutions in Ghana and potentially other developing countries are not presenting convincing cases to their institutional leadership/management teams to receive the necessary support both in funding and expertise. It was apparent in the data that there is areal the need for HIT leadership to be adept at determining costs relating to pre-implementation and post implementation (operational and maintenance costs) as well as developing scenarios of usage rates and issues of reimbursement. Participants noted that the introduction of e-Claims by the national health insurance agency (NHIA)[26] was going to make reimbursement of services offered through e-Health easy. e-Claims was introduced by the NHIA to enable faster processing of claims for hospitals that offered NHIA covered services to eligible patients who at registered at partner healthcare facilities.HIT funding and services reimbursement in this research study is defined as the availability of the necessary to acquire the requisite inputs to implement, operate, maintain and sustain HIT and for payees to pay for eligible services.

Figure 6.7: Nvivo text search query results for Funding

[26] NHIA is the public insurance agency



Source: Nvivo output

Table 6.4: Step 2 Output: summary of concepts of HIT adoption readiness of public hospitals to adopt HIT

Categories	Ideas/Concepts
Planning readiness	• Strategic plan • Needs assessment • Identified/selected healthcare services • Experienced key personnel • Evidence of HIT usefulness • HIT national coordinating office • IT governance
Awareness creation & Buy-ins readiness	• Staff/stakeholders consultation • Feedback about stakeholders • Identification of potential collaborators • Support of board of directors • Support from management leadership • Identified internal/external champions • Availability of reliable communication channels • Awareness creation
Change management readiness	• Stakeholders consulted in HIT choices • Proof of experience in implementing HIT • Availability of change leaders • Availability of multi-layer change teams • Availability of measures for anticipated future changes • Feedback mechanism
Value proposition readiness	• Technology supports the care delivery mission of the hospital • Initiative supports organizational/hospital goals • Issues of cultural responsiveness • Users appropriately credentialed/trained • Opportunities to collaborate with other hospitals for care delivery • Standards/consistency issues
Funding readiness	• Budgetary issues • Equipment needs • Continuing cost determination/projection

	• Scenarios about repayments • ROI
HIT services reimbursement readiness	• Covered services • Investigation of allowable billing codes for NHIS • Investigation of patient eligibility for HIT delivered services and payment by NHIS • Investigation of provider/facility requirement
Technology infrastructure, system implementation and quality assurance readiness	• Determination of timelines for implementation/installation • Structure and training program • Updates plan • Service delivery technologies • Service delivery technology meeting organizational needs • Issues of technology quality • Issues of information quality • Issues of service quality • Information about next step • Types of technologies • Needs of hospitals in relations to technology • Technical practicality issues • Examination of technology in relations with needs • Technology suitability with workflow/existing systems • The hospital has the appropriate amenities to HIT. • Availability of reliable Internet. • Availability of relevant hardware and software • Needed hardware and software are available at reasonable prices
Policies readiness	• Policies, standards, and procedures dealing with liability issues • NHIS repayment policies • Guide for using HIT • Changes update mechanism
HIT practice regulation readiness	• Credentialing, licensing, and privileging • Practitioner licensing requirement • Patients sites determination • Hospital sites determination • All necessary requirements • Service sites requirements • Evaluation of technology practices against national standards and laws • Provision allowing services in other regions
Data protection readiness	• Technology conforms to patients' health information confidentiality • Issues of authorization/accessibility
Workforce readiness	• Adequate and dedicated IT personnel • Willingness to embark on HIT project • Happiness among users • Personnel training plans • Education and support programs for relevant stakeholders • Identification of individual/group roles

Source: Developed for this study

6.2.4 Building over-arching themes in the data

Qualitative research uses analytical categories to describe and explain social phenomena (Pope et al., 2000). These concepts/codes, which were the outputs from step 2 in this process of analysis, were derived through hybrid – both deductive and inductive respectively. Deductively, themes were derived through the lens of the theoretical framework developed from literature. In doing so, the researcher engaged literature prior to the analysis, an activity Braun and Clarke encouraged. One of the objectives of the research was to discover new factors which either promote or impede IT adoption among public hospitals in Ghana. As a result, prevalence was not crucial for the identification of concepts/themes in the context of inductive approach. As such after the data was collected, the researcher no longer felt the need to engage literature anymore for the purposes of identifying concepts and if possible themes. In this respect, Braun and Clarke (2006) contend that a more inductive approach is necessary– grounded theory, which is an inductive process of identifying analytical categories as they emerge from the data. This implied formulating hypotheses from the ground or research field upwards rather than defining them a priori (Glaser and Strauss, 2009) would be enhanced by not engaging with literature in the early stages of analysis. Instead, the researcher familiarized himself with the data right from transcription through to back and forth reading. The researcher did this by coding the data, whilst simultaneously trying to fit in to a pre-existing coding frame or the theoretical framework developed during the literature review – in accordance with the research questions.

Thematic analysis is a method of recognizing patterns within the data, where developing themes serve as the categories for study. Initially the data were read and reread to identify and index themes and categories: these mostly centered on particular phrases, incidents, or types of behavior. This phase, which re-focuses the analysis at the general level of subject, rather than codes, involved categorization the different codes into possible themes, and organizing all the relevant coded data extracts in the identified themes. To search the themes, the researcher essentially started by analyzing the codes and paid attention to how different codes may combine to form an overarching theme. Each of the categorized responses or codes, output in stage 2, (see Table 6.3) had one or more associated themes that gave a deeper meaning to the data.

As suggested by Fereday and Muir-Cochrane (2006), different categories of codes/concepts were collapsed under five main over-arching themes. This phase ended with a collection of candidate themes, and all extracts of data that have been coded in relation to them (Braun and Clarke, 2006) (refer to Table 6.5) At this point in the process of searching for themes, a sense of the implication of the individual themes began to emerge. However, nothing at this stage was abandoned as a result of uncertainty as to whether the identified conceptual themes would hold as they were in explaining the explored themes, or some would need to be recombined, refined and disconnected, or rejected. The output of the refinement process can be seen in Table 6.5

Table 6.5: Summary of built overarching themes

Over-arching theme	**Categories**
Core readiness	Planning
Organizational cultural readiness	Creating awareness and buy-in Change management
Operational resource readiness	Finance & sustainability HIT insurance Workforce
Technology readiness	System implementation & quality assurance Technology infrastructure
Regulatory and policy readiness	HIT practice regulation Data protection Policies
Value proposition readiness	Value determination

Source: developed for this study

In the analysis of the data, the other elements that prevailed were factors capable of *promoting* HIT adoption in public healthcare organizations and those capable of *impeding* HIT adoption, summarised in table 6.6 below:

Table 6.6: Summary of factors promoting and impeding HIT/e-Health adoption in Ghana

No.	Factors promoting HIT adoption in public hospitals in Ghana	No.	Factors impeding HIT adoption in public hospitals in Ghana
1	Strategic planning	1	Lack of awareness
2	Needs assessment	2	Misconception about use of computers among low cadre healthcare providers
3	Identification of need for HIT services	3	Lack of IT training in healthcare training institutions
4	Creation of awareness	4	Lack of leadership
5	Marketing of IT adoption initiative through formal strategic document	5	IT infrastructure for IT personnel by Ministry of health
6	Stakeholder involvement	6	Gaps between HIT plans and practical implementation
7	Review of existing policies	7	Low- ranked IT positions in healthcare environment
8	Collaboration with relevant agencies	8	Lack of recognition of potential of HIT
9	Training of end-users	9	Ill-equipped rural healthcare facilities impeding collaboration
10	Imbedding HIT/IT into medical/nursing curriculum	10	Lack of large scale HIT implementation experience
11	Change management in health training institutions	11	Outdated ICT policies
12	Data collection on various HIT projects	12	Lack of understanding of HIT systems
13	Lessons learned	13	Lack of coordination at national level
14	Cohesion of existing HIT projects	14	Cyber phobia among the older and low-level healthcare cadres
15	Clear business cases	15	Workflow conflict/disagreement
16	Evaluation of existing projects	16	System integration difficulties
17	Development of telecommunication infrastructure	17	Easy abandonment of systems by care providers/end users
18	Potential for locally/need driven HIT initiatives	18	ICT not represented at top level in healthcare environment in Ghana (developing countries)
19	Establishments of ministerial and technical ICT/IT committees by national health departments in partnership with relevant agencies	19	Lack of funds
20	HIT strategies with specified goals/objectives	20	Lack of evidence of proper functionality of deployed HIT
21	Workforce/Resource availability	21	Lack of IT governance
22	Information about existing HIT initiatives	22	Lack of IT directorate in the healthcare environment

23	Accreditation of HIT sites/partner healthcare facilities	23	Lack of lack national standards for HIT
24	HIT national standards	24	Software continual upgrade and maintenance
		25	Issues of legacy systems
		26	Lack of experienced workforce
		27	Lack of respect for patient information
		28	Lack of collaboration with agreed/accredited healthcare facilities
		29	Informal economy
		30	Lack of ICT infrastructure in rural areas
		31	Corruption
		32	Lack of understanding of the potentials of ICT in healthcare context

Source: Developed for this study

6.2.5 Reliability and validity

Qualitative research can make a valuable contribution to the study of quality and safety in health care (Dixon-Woods et al., 2004). However, there are no easy solutions to the problem of improving the quality of care (Pope et al., 2002). A good and rigorous qualitative research, which produces explanation using words and phrases (themes) can provide convincing answers as to why the need to embrace change and do things differently cannot be compromised. In this research study, the achievement of internal validity started with the pilot study. The researcher conducted a pilot study with six participants prior to the actual interview in which all respondents were subjected to the same protocol/guide. These participants were academics in the field of Health Informatics and industry practitioners. Feedback from the pilot study was used to improve the interview guide

The essence of qualitative research is to make sense of and recognize patterns among words in order to build up a meaningful picture without compromising its richness and dimensionality (Leung, 2015). Although the term ‘Reliability’ is a concept used for testing or evaluating quantitative research, the idea is most often used in all kinds of research. While reliability and validity are treated separately in quantitative studies, they are not viewed separately in qualitative research. Instead, terminology that encompasses both, such as credibility, transferability, and trustworthiness is used (Golafshani, 2003). Credibility and transferability were achieved in this research study as the contents of the interview guide were discovered from reviewed literature for this research study.

Furthermore, in this research study, in digital audio-records as well as in the researcher's field notebook, respondents' natural attitudes at some points in the course of their interviews revealed the relevance of the interview guide/aide memoire used, which actually contributed to the trustworthiness of the research and confirmation of findings of previous related studies, symbolizing transferability. In essence, by documenting how people really behave in "natural" everyday situations and examining in detail what people mean when they describe their experiences, feelings, attitudes and behavior are seen as providing an accurate representation of the phenomena studied (Pope et al., 2002). Therefore, once the data was coded and themes identified, a preliminary readiness assessment model was developed, and the development of a quantitative instrument was resumed. In developing the preliminary adoption readiness model, direct quotes from respondents demonstrate the trustworthiness of this study. The qualitative research actually contributed in ensuring that any themes uncovered reflected detailed underlying issues surrounding the readiness of public hospitals in Ghana to implement and use HIT to enhance the quality of healthcare in Ghana.

6.2 Conclusion

In this chapter, the findings from the in-depth interviews have been presented. They include detailed analyses of the raw data; the experiences and views of participants gathered from the one-on-one interviews have led to the identification of key concepts/codes and the building of over-arching themes. In all six over-arching themes (see Table 6.5), these themes will be used to develop an initial HIT adoption readiness assessment framework in the next chapter, 7 while the concepts will be used as measuring items in the survey instrument to be developed. Furthermore, the analyses have also led to the identification of factors promoting HIT adoption in public healthcare facilities in Ghana as well as those impeding the implementation of HIT in the same healthcare organizations. In Chapter 7, the development of the initial HIT adoption readiness assessment model for public healthcare facilities in Ghana, will presented

CHAPTER 7: DEVELOPMENT OF PRELIMINARY HIT/e-HEALTH READINESS MODEL

Overview

In the preceding Chapter 6, the findings from the in-depth interviews were presented. The main outcome of the chapter, the qualitative data analysis was the identification of themes and concepts. The chapter discussed the approach used to collect the qualitative data and the processes involved the interview population as well. The chapter then presented and discussed a four-step qualitative data analysis, which led to the identification of the themes and concluded with a discussion on reliability and validity in qualitative research.

7.0 Introduction

In this chapter, the themes from the analysis of the qualitative data in Chapter 6 will be used as key input towards the development of a preliminary HIT adoption readiness assessment model, serving as candidate constructs.

Chapter 3 provided detailed information about selected prominent theories and models that have influenced technology adoption over the past decades, which led to a proposed framework for HIT readiness/adoption in public hospitals in Ghana. While each of the selected theories and models had appropriate constructs, it was evident that a single one could independently apply to this study. It was realised that a proposed model could be developed by combining some selected relevant constructs, which reflected the current complexities that existed in the adoption and use of information technology in the healthcare environment in Ghana.

Against this backdrop, this chapter establishes an argument from the literature and from the analysed qualitative data from the interviews in the healthcare environment with a perspective of elucidating the rationale behind the chosen theories and models for this research study.

In this chapter and sections that follow, a preliminary framework is developed. It is based on theories/models from the fields of business and IT/IS. Important concepts include the following: organization; technology; environment, and stakeholders and value proposition. This translates to imply that the themes identified during the analysis of the qualitative data in the preceding chapter would serve as candidate constructs for the development of the preliminary framework alongside hypotheses to be tested for the readiness and adoption of HIT.

7.1 HIT readiness studies in Ghana

In Ghana, there appeared to be no studies which investigated the readiness of public healthcare facilities ex-ante to implementing HIT on a large scale. There are however, a number of public healthcare facilities in Ghana that are at different stages towards implementing HIT systems. The few studies found in literature have been ex-post implementation evaluation studies (Acquah-Swanzy, 2015, Afarikumah and Kwankam, 2013, Akosua and Aseweh, 2011, Adjorlolo and Ellingsen, 2013). The approach of this research does offer an opportunity for a comprehensive view of HIT adoption readiness in public hospitals in Ghana, which may be applicable in other developing countries.

In the context of this research study, which is the use of IT in the public healthcare in Ghana, readiness can be defined as the state of preparedness of hospitals, persons, systems and environments to meet the required situation for a sustainable IT deployment in accordance with a planned structure of actions. This definition of readiness was established on the diligence of the hospitals themselves as organisations and the environment in which they operate in the context of healthcare delivery on the back of other government arms' functionality and a reserve of support services.

7.2 Theoretical framework

In this preliminary theoretical framework, theories formulated will explain and predict issues pertaining to the adoption of HIT in public hospitals in Ghana and, at the same time, challenge and extend existing knowledge within the limits of critically binding assumptions about HIT adoption in Ghana and other developing countries. The theoretical framework is the configuration that can hold or support a research theory and introduces and describes the theory that explains why the research problem being studied exists (Abend, 2008).

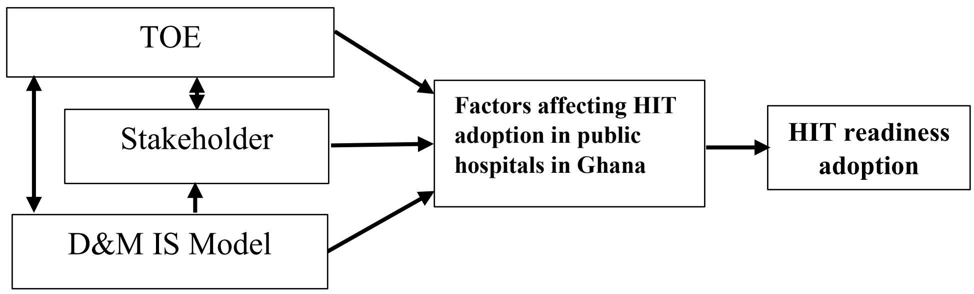
Tornatzky and Fleischer (1990) developed the technology-organization-environment (TOE) framework to describe the organizational components that affect a firm's adoption decisions. In their framework, the authors state that three principle contexts – technology, organization, and environment – affect the ability by which an organization adopts a new technology. In the context of technology, technologies available to a firm are studied, which may be deemed useful towards the improvement of overall productivity of a firm. Technologies are considered internally and externally respectively. Organisational context is defined in terms of resources available to support the nurturing decision to adopt the new technology or innovation. For the purposes of this research study, organizations are the public healthcare facilities. The context of the environment represents the situation in which the firm operates and is influenced by the industry itself, its competitors, the firm's ability to access resources such as funding and workforce, HIT supplied by others and interactions with the government and other regulatory bodies. A plethora of previous empirical studies (Zhu et al., 2006a, Zhu et al., 2006b, Iacovou et al., 1995, Chong et al., 2009) have applied TOE as a supporting theory and investigated the adoption of new technologies by organizations predominantly in the production and other non-health domain organizations, in particular the adoption of e-business. Also, there are many studies that adopted Innovation Diffusion Theory (IDC) by Rogers (1995a) to investigate the adoption of innovation at firm-level, principally employing (1) characteristics of the technology; and (2) users' perceptions of the system antecedents.

While Roger's IDC theory has been at the forefront of technological acceptance by firms and individuals, it lacks any construct about the actual characteristics of the firm in question. Furthermore, organizational decisions to adopt any technology or innovation have largely been influenced by the environment of the organization – customers, suppliers, other trading partners, competitors, and government regulations – that provide barriers and incentives to technology adoption. For instance, in this research study, the adoption of any HIT by any public healthcare facility in Ghana is seen to be largely influenced by how well a healthcare facility is equipped with the relevant supporting resources and available regulation policy government and other regulatory bodies, which are environmental issues. This will be investigated further when the characteristics of healthcare facilities (organization) and their environment in conjunction with technology (internal and external technologies) are considered. For instance, a thematic analysis of the one-on-one interviews with relevant participants – largely heads of IT in public hospitals, identified factors that cut across technology (gathering information about technology, technology selection/testing, planning for implementation); organization (e.g. strategic planning, change management, engagement and buy-ins, value proposition, and workforce); and environment (regulatory and policy). As such it was appropriate to ground this study in a framework that considers the influence of the technology, the healthcare organization, and the environment to account for broader environmental factors likely to influence the scope and degree of HIT adoption among public hospitals in Ghana. Therefore, the use of Tornatzky and Fleischer's (1990) technology-organization-environment (TOE) framework enables the consideration and proposed investigation of specialized factors likely to influence the readiness and adoption of HIT by healthcare facilities.

Value proposition in e-Health technologies are often complex to address, especially when the benefits are on a social level. Such social value propositions are difficult (or perhaps even impossible) to quantize or monetize towards the e-Health technology directly (van Limburg and van Gemert-Pijnen, 2011).Value in this context is used to identify functionalities of an e-Health service that bring socio-economic and healthcare value to patients and/or healthcare professionals comprise specific elements such as better clinical care, safety, timeliness of care, quality, effectiveness and efficiency (Valeri et al., 2010). People simply stop using technologies that do not correspond in any way with their daily lives, habits, or rituals (van Gemert-Pijnen et al., 2011). In this regard, there was a perceived need to investigate the extent to which value proposition was embedded in HIT system being developed to the time the systems go live, hence the use of Stakeholder theory by (Freeman, 1984a). Therefore, it became apparent that a combination of constructs of TOE and Stakeholder Theory would provide the necessary constructs to wholly investigate the readiness of healthcare institutions in Ghana to adopt HIT systems.

To ensure the quality of developed systems as part of technological lens of TOE, user satisfaction was being considered. The need to consider information quality, system quality and service quality was deemed necessary to cement the assurance that users will get the best out of the systems being adopted in the context of meaningful use, hence the use of the D & M IS Model. The use of multiple theories has been limited in the investigation of readiness of healthcare institutions readiness to adopt HIT systems.

Figure 7.1: Theoretical underpinnings for this study



Source: Developed for this study

7.3 Research model

The reliability of any research findings depends largely on the quality of data collected and the rigorous of the data analysis which are directly associated with the research design. The development of this model included the following steps:

An extensive literature search and review in the field of HIT/e-Health was conducted. A myriad of studies focusing on the readiness and adoption of e-Health were collected in search of commonly assessed readiness factors. The factors identified and explored were *Core readiness,* *Engagement readiness, Technological readiness, HIT funding readiness, Regulatory and policy readiness* (Biruk et al., 2014, Chipps and Mars, 2012, Coleman and Coleman, 2013b, Coleman et al., 2012, Durrani et al., 2012, Jennett et al., 2003b, Jennett et al., 2005b, Justice, 2012, Khatun et al., 2015, KHOJA et al., 2008a, Khoja et al., 2007a, Leon and Schneider, 2012, Li et al., 2012a, Mucheneh, 2014, Nahm et al., 2008, Oio et al., 2007, Qureshi, 2014a, Scharwz et al., 2014, Simon et al., 2008, Snyder-Halpern, 2001b, Tamburis et al., 2012, Touré et al., 2012) and *Workforce readiness* (Adjorlolo and Ellingsen, 2013, Acquah-Swanzy, 2015, Biruk et al., 2014). *Change management readiness* was identified in literature as relevant to e-Health readiness (Heeks, 2005a, Lackner, 2015, Ford et al., 2006, Huang et al., 2010) but was not assessed as part of e-Health adoption readiness in previous studies. Each, however, had different and limited measuring tools for the same factors. This study intends to explore the above identified HIT readiness factors from literature for their applicability, rename them where appropriate, discover more factors and develop measuring instruments.

The specific objectives of exploring the above readiness factors were to:

- Obtain a deeper understanding of the factors identified in literature used in assessing HIT readiness in the context of public healthcare facilities in Ghana for the identification of new factors and where applicable/appropriate renaming through a thematic analysis
- Identify key categories/concepts, which could be used in assessing/measuring the identified readiness factors
- Use the outcome of the analyzed qualitative data (concepts/themes) to develop a survey instrument for quantitative data
- Test the validity of the measurement instruments developed through a case study with a hospital that is in the process of implementing an HIT.

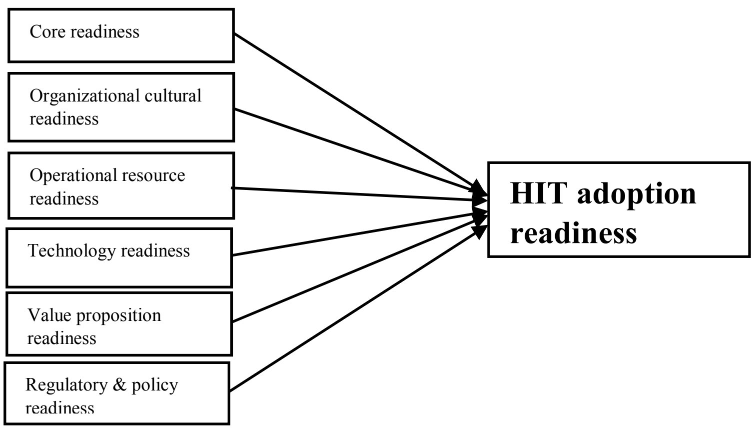
7.3.1 Stage 2: Qualitative data collection

A qualitative data was collected through in-depth interviews using an *aide memoire* with 13 respondents from the following sampling matrix: IT managers at public hospitals in Ghana, HIT project leaders, lecturers in biostatistics/health informatics, National Health Insurance Agency (NHIA), Ministry of Health (MoH), Ghana Health Services GHS), the National Information Technology Agency (NITA), Ghana (Refer to Table 5.3 for details). Interviews, which lasted between 55 minutes and 80 minutes were all audio-recorded, later transcribed and thematically analysed.

7.3.2 Qualitative data analysis

The researcher adapted the step-by-step guide to qualitative data analysis developed by O'Connor and Gibson (2003) to thematically analyse the data. Pattern recognition was preformed within the data, where evolving themes become the categories for analysis (Fereday and Muir-Cochrane, 2006). To do this, the researchers developed categories out of the identified ideas and concepts at the beginning of the data analysis process to enter the abstraction process. In order to find and organize concepts, the researcher firstly focused on the primary message content from the various responses. Initially the data was read and reread by all three authors to identify and index themes and categories: these mostly centered on particular phrases, incidents, or types of behavior. This phase, which re-focuses the analysis at the general level of evolved themes, rather than codes, involved sorting the different codes into prospective themes, and organizing all the relevant coded data extracts within the emerged themes. To search the themes, the researchers essentially started by analyzing the codes and paid attention to how different codes might combine to form an overarching theme. There are six primary themes/constructs that emerged and compose the research model (see Figure 7.2 below) for HIT/e-Health readiness assessment. The six constructs include (1) core readiness; (2) Organizational cultural readiness; (3) Operational resource readiness; (4) Technological readiness; (5) Value proposition readiness; and (6) Regulatory and policy readiness. These six components are discussed below.

Figure 7.2: Preliminary HIT adoption readiness assessment model



Source: Developed for this study

7.3.3 Core readiness

Planning to efficiently allocate the resources, create internal accountability, and work productivity, there is a need for a thorough HIT needs assessment. Need assessment provides evidence and a framework on which planning is based. Most HITs are implemented without performing a needs assessment with the end users healthcare providers (Strauss et al., 2015). A comprehensive needs assessment on the relevance of the HIT and the services to be delivered is inevitable when a healthcare organisation is poised for a successful HIT implementation (Mudd-Martin et al., 2014, Turman, 2013). It is an approach that helps people make informed and justifiable decisions that accomplish the desired results and include special health characteristics and needs of the beneficiary population. It has the potential to identify instances of effective HIT technologies used in comparable circumstances. Previous researchers such as Lackner (2015) found that a comprehensive assessment will involve a combination of methods that allow the organization to 'see the full picture' while employing multiple approaches to form a valid and reliable assessment.

While HIT need assessments have not been undertaken in some hospitals, with the right leadership other hospitals were setting the pace.

The earliest decisions that lead to development projects (or programs) [alongside the identification analysis and involvement of various stakeholders] are among the most critical in determining long-term success (Watkins et al., 2012). Data gathered raised questions about who has the right to make such decisions.

Information Technology (IT) governance has emerged as a fundamental business imperative, and rightfully so, because it is key to realizing IT business value (Peterson, 2004). Decisions were made by a few top executives (subordinates did not question their superiors) and boards rubber-stamped decisions (McNurlin and Sprague, 2006). IT governance describes the distribution of IT decision-making rights and responsibilities among different stakeholders in the enterprise and defines the procedures and mechanisms for making and monitoring strategic IT decisions (Peterson, 2004).

The application of Information Technology Governance (ITG) was motivated by the private sector in the 90s, as a way to achieve excellence, provide new services, and increase profitability of IT investments (Al Qassimi and Rusu, 2015). A governance cycle defines who has a decision right (the right and responsibility to make a decision) and an input right (the right to provide input to a decision but not make the decision) (McNurlin and Sprague, 2006).

There are many silos HIT projects in Ghana in partnership with the Ghana MoH and GHS. However, these projects have no shared objectives with those of the Ministry of Health (MoH) and Ghana Health Services (GHS). As a result, many respondents spoke of the need for an HIT national coordinating office.

Some respondents considered that NITA could be considered a national IT coordinating office, but this is yet to be clarified. While some respondents agreed it was NITA, others argued NITA is only an implementing agency, which needs to do more to bring all related projects under its control. This way lessons learned from various projects could be brought to bare for better development of relevant HIT projects and their implementations.

Hypothesis 1: *Core readiness will have positive impact on the* HIT readiness of KATH.

7.3.4 Organizational cultural readiness

As information technology (IT) facilitates the globalization of organizations, management is faced with the responsibility of adapting to a rapidly changing environment filled with uncertainty and anxiety (Schrodt, 2002). In the healthcare setting, the lack of evidence-based HIT initiatives, lack of ongoing accessibility to ICT tools in healthcare organizations and by healthcare providers in developing countries, coupled with the continuous rapid evolvement of IT, make the adoption of HIT even harder, which ultimately affects organizational culture. Organizational culture is a set of shared assumptions that guide what happens within them by defining appropriate behaviour for various situations (Ravasi & Schultz, 2006). Organizational culture affects the way people and groups interact with each other, with clients and with stakeholders (gotham Culture, 2017). *Teamwork*, *climate-morale*, *information flow, involvement, supervision*, and *meetings* are central to any construction of organizational culture (Gibson and Papa, 2000, Lindbo and Shultz, 1998).

While the goal of HIT programs is to deliver safe, efficient, high quality healthcare, the complexities of healthcare coupled with stakeholder perceptions and acceptance have emerged as significant challenges for ubiquitous adoption (Black and Sahama, 2014). These increased complexities have emerged due to earlier neglect of the critical role stakeholder engagement and consultations held in realising success. History shows that shared HIT failures often trace their roots back to failure by organizations to deal with organizational culture including engaging stakeholders to successfully foster any changes necessary for ubiquitous adoption of HIT systems.

To this effect, some previous researchers have found that stakeholder engagement is key when it comes to the execution and accomplishment of information systems in the healthcare or clinical backgrounds (Downing et al., 2009, Lorenzi et al., 2009, Lorenzi et al., 2008, Berg, 2001).

Prior work on implementation of clinical information systems provides broad guidance to inform effective engagement strategies (Hartzler et al., 2013). This prior work resonates with need assessment towards establishing a case for the development of programs and interventions, which will seek to identify the outcome of the situation analysis. In the context of this research study, engagement and buy-ins are the processes by which all relevant stakeholders are actively occupied with discussions about a HIT to be deployed; weighing up its perceived advantages and disadvantages in order to gain insight into foreseeable issues concerning its deployment with the intention of gaining their eventual interest or attention.

The quality of these engagements/workshops with stakeholders will determine how well healthcare delivery in public health facilities thrive on the implementation of HIT to opt for an improved quality, affordable and quality healthcare for the ordinary Ghanaian relying on the public healthcare facility for better health.

Change management in the context of HIT adoption readiness in public hospitals in Ghana may be seen as a structure of activities to be followed to apply change management brought about by the introduction of HIT in order to drive individual transitions and ensure that the change (introduction of HIT) meets its intended outcomes. The culture and history of healthcare delivery in Ghana was seen as an integral part of change management in the healthcare environment in Ghana as much as stakeholder involvement. This had to do with paper written/folder-based and in person-presentation against automation and electronic care systems. Cultivating an environment conducive to change entails gaining commitment and overcoming resistance (Antwi and Kale, 2014). Cultivating this environment implies involvement of core stakeholders' right from the early stages of the project.
By involving stakeholders, an understanding of the motives of those affected by the change and determining whether they view the change positively or negatively can be accomplished. As opposed to planned change, which makes an assumption that, overall, the change targets within an organization will agree with management's vision of change and the steps designed to transition towards the "changed" state (Bamford and Daniel, 2005), when introducing changes that affect the workflow of healthcare providers, it is important to consult with them

By placing an emphasis on pre-planned processes, timetables, and objectives, all of which are developed by management, this approach obscures the impacts employees (care providers) have on change initiatives (Antwi and Kale, 2014).

In the case of HIT implementation in public hospitals in Ghana, the need for staff and end-users to be involved in choosing the appropriate technology, setting relevant policies, and drafting assessment methods has been recognised. Within the same context, the need for a feedback mechanism for both care providers and clients/patients to comment on selected HIT service provision challenges, concerns, successes, and setbacks was apparent. This way of communicating with users provides room for continuous improvement of the systems with down-time for improvement considered as a way of learning for betterment of the systems deployed. Change management processes will be incomplete without a proper HIT deployment plan that evidently finds further expected variations, while considering budgetary issues and other means available to expedite the change process.

Hypothesis 2: *Organizational and cultural readiness will have positive impact on the* HIT readiness of KATH.

7.4.3 Technological readiness

Technologies may prove frustrating for frontline clinicians and organizations as the systems may not fit their usual workflows, and the anticipated individual and organizational benefits take time to materialize (Cresswell et al., 2013). An important factor in vendor and technology selection in the context of the readiness of public hospitals in Ghana to adopt HIT will be seen to be the ability of the technology to be adapted to fit the local context need. Technologies that can have technical adjustments made to them to suit the constant modifications of the environment may have greater acceptance and adoption. Many hospital IT heads were not usually consulted together in tandem with their end-users (clinicians and non-clinicians) in the activities leading up to the selection of a “suitable” technology for adoption.

In relevance, there has to be a consultation with all relevant stakeholders when it comes to selecting an appropriate or acceptable technology after the relevant information about various technologies has been gathered for selection.

In planning for the implementation of the selected technology, Cresswell et al. (2013) are of the view that it is key to first clarify what challenge(s) the technology is designed to confront. In the context of this study, implementers will be asking what clinical and non-clinical challenges will be solved by deploying a particular HIT technology and then build consensus around the strategic vision of the healthcare facility.

Hypothesis 3: *Technological readiness will have positive impact on the* HIT readiness of KATH.

7.4.4 Value proposition

The philosophies of healthcare organizations in the context of HIT will hardly be any other than those of the benefits of widespread adoption and application of integrated, inter-operable health IT solutions. The value of these HIT systems to both care providers and receivers is in improve the quality of health care; preventing medical errors; reducing health care costs; increasing administrative efficiency; and decreasing paperwork. Furthermore, it may also include expanding access to affordable health care without compromising cultural responsiveness in the design of the HIT practices. In the data, respondents appear to be suggesting that the one single value that can be derived from the HIT is the timely availability of quality data. In Ghana, as in other developing countries, hard copy older (files) are the standard method of keeping patient records. The application of this hard copy or material filing systems is that every patient must present to a receptionist with a national health insurance card With folders prevalent in hospitals, it is very easy for individual patient folders to get lost or be passed onto the wrong hands. However, being able to reassure patients that measures have been put in place to secure their information when the HIT deployment takes place, will be an added value in the context of electron exchange/transmittal of health information amongst authorized/participating agencies to connect relevant technology services. As key value propositions, data enrichment, co-creation and discovery require a platform that will encourage cooperation and collaboration across healthcare organisations (Black and Sahama, 2014).

In identifying value for HIT implementation, there is always the need to make sure that the HIT under consideration bring into line with the overall goals of healthcare organizations in order to serve its relevant patient population. This will imply that the technology under consideration meets the healthcare facilities' medical goals and values of healthcare care delivery.

Hypothesis 4: *Value proposition readiness will have positive impact on the* HIT readiness of KATH.

7.4.5 Operational resource readiness

HIT is a valuable tool for enhancing healthcare delivery. As HIT essentially uses ICT platform, it requires resources ranging from finance to specialized workforce to be able to deliver on its promises. Operational resources in HIT implementation represent the non-technological resources. According to data organized in this research, these resources were identified as finance and workforce availability.

In the past, revenue generation and billing rather than clinical needs compelled most investment in IT in healthcare. This aspect of IT in the healthcare industry is expected to receive more attention as the National Health Insurance Scheme (NHIS) has cemented its place in the healthcare service of Ghana. Nowadays, now with many attempts by public hospitals to implement HITs focusing on clinical services, the marriage of the two systems has the potential to improve healthcare delivery in Ghana both in clinical settings and in revenue generation streams. For both of these related systems to be implemented to work efficiently side by side or in an integrated way, the need for finance to drive value and sustain these systems has never been more important.

e-Health services need to deliver on their operational and strategic objectives by providing both value and sustainability. The issue of sustainability, however should also be seen within time and changing social, economic and political contexts (Khan, 2000). Sustainability of an e-Health intervention refers to its "shelf life" and comprises the technical, financial, scientific, and other infrastructure necessary to maintain the implementation of the e-Health program over time (Wu et al., 2014).

In the context of e-Health projects, Valeri et al. (2010) also defined the word ‘sustainability’ as a system which has passed the pilot phase and is now fully operational. Likewise, a sustainable e-Health service will no longer be financed by external funds (e.g. project funding) (Krappe and Raitoharju, 2014). To achieve sustainability of both clinical and billing HIT systems there is the need for a rigorous cost/benefit analysis; determination of continuing costs and return on investment (ROI). There is also the need to develop scenarios to determine repayment and use rates necessary to meet costs and continuing expenditures. There is also the need for hospitals intending to implement HIT to investigate which covered services can be delivered by HITs such as e-Health technologies and be reimbursed by the National Health Insurance, other government payers, and commercial carriers as well as clients/patient eligibility.

There is a growing recognition worldwide that an essential component of a successful deployment of HIT is a competent workforce (Hersh, 2010). This is most evident from efforts that have focused on implementing HIT in developing countries and this research study is one such effort. This kind of workforce shortage is not what could simply be termed a “lack of IT gurus”. In what appears to be a striking revelation, data gathered suggest that the Ministry of Health Ghana (MoH) does not have an employment structure in place that supports the hiring of qualified IT personnel and that IT was not a core function of the Ministry. Instead, the MoH capped the number of non-clinical staff who could be employed. It was apparent, however, that the real workforce problem in Ghana was more complex.

From a healthcare organizations’ view point, the issues of adequacy of the “exceptional” and dedicated workforce, willingness among existing staff, comfortability of end-users, training plans and plans for educational sessions to help create awareness and acceptance, must were found to be more apparent, according to the data collected.

On the other hand, there appeared to be a general lack of recognition for the potential of IT to be used to improve healthcare delivery services. The majority of respondents also believe that the relevant skills are out there in the workforce, but there is no employment structure in place for the hiring and retaining of personnel with the requisite skills. That is changing. The role of IT is beginning to be recognised due to past successes with e-Health related implementations.

Overall, respondents believe more needs to be done in order for IT to be fully recognized as an important tool with the potential to improve the quality of healthcare delivery in Ghana.

Hypothesis 5: *Resource readiness will have positive impact on the* HIT readiness of KATH.

7.4.6 Regulations and policy

An absence or inadequacy of legislation and policies, along with liability concerns, may hamper the implementation of HIT systems at the organisational and health professional level. This appears to be the situation in Ghana when it comes to the adoption of any HIT systems.

Even though there were claims about some level of progress being made regarding HIT regulation and policy, it was unclear whether this was at an individual or national healthcare facility level. The general understanding, however, was a lack of reliable policy document.

When it comes to protecting patients' information, everyone who handles or has access to patient information be fully conversant with the patient data/information protection act. For the purpose of this research, protected health information is defined as patients' personal health information (PHI), medical history, test and laboratory results, and other data including patients' demographic information that a healthcare professional accumulates to classify an individual and decide on appropriate care.

The problem with patients' information being so easily accessible is a deep seated privacy issue. Not only was it found in the data that there were no policies protecting patients' information, but also that some healthcare providers have no knowledge of or regard for the privacy of the public health information.

This poses to questions about there being policies in place with regard to liability issues relating to the delivery of services using HITs. However, in Ghana and potentially other developing countries, healthcare organizations are increasingly leveraging analytics to gain valuable insights which might solve inefficiencies and streamline workflows.

Hypothesis 6: *Regulatory and policy readiness will have positive impact on the* HIT readiness of KATH.

7.5 Conclusion

There is a parallel need for further exploration of the regular HIT adoption readiness factors identified in literature for their applicability in various contexts and to develop reliable measuring instruments capable of predicting the adoption readiness of healthcare institutions. According the data analysed, *Core readiness; Organizational cultural readiness* (explored as engagement and change management) and *Operational resource readiness* (as finance and reimbursement and workforce); *Value proposition readiness; Technological readiness; and Regulatory and policy readiness* emerged as the six over-arching themes and as such were more applicable to this study. When fully empirically validated, the framework will offer a standard and reliably developed measurement scale capable of evaluating HIT adoption by public healthcare facilities in Ghana and in other developing countries. The framework when adopted is expected to improve the success rate of HIT implementation with increased optimism.

CHAPTER 8: QUANTITATIVE DATA COLLECTION

Overview

In Chapter 6, there was elaboration on the qualitative data gathered through the in-depth interview process and how this data was analysed. The analysis of the data informed the development of an IT readiness assessment model, which is a key deliverable of this research study. More so, themes that emerged from the thematic analysis of the qualitative data served as key inputs in the development of the survey questionnaires that helped in gathering quantitative data – views and opinions from a representative sample of the wider clinicians and non-clinicians. This chapter applies the survey questionnaire to the Komfo Anokye Teaching Hospital (KATH) in the Ashanti Region of Ghana, as a way of assessing the readiness of KATH to successfully implement other HIT technologies after Hospital Administration and Management System (HAMS) implementation.

8.0 Introduction

The research model developed for this study seeks to assess the HIT adoption readiness of public healthcare facilities in Ghana by way of identifying factors which either promote or impede adoption readiness. Phase 2 of this study sought to collect rich qualitative data about HIT adoption from heads of IT in public hospitals, senior managers, leading HIT projects/initiatives in Ghana and academics in relevant fields. The data collected and analysed data Phase 2 led to the development of a preliminary HIT adoption readiness model. The model is made up of concepts/constructs and variables, which were thematically generated. In this phase (Phase 3) of the study, quantitative data on the readiness of KATH to successfully expand on the HAMS system was sought from relevant staff of KATH (clinical and non-clinical officials) through a case study approach to the phenomenon of HIT adoption readiness assessment. Therefore, the objectives of this final phase of the research study were:

1. Collect quantitative data using the measures of the variables of the main themes identified from literature and qualitative data to enhance the understanding of HIT adoption readiness assessment in Ghana and other developing countries; and
2. Investigate the influence of the measures identified in the qualitative data on the variables and their ability to successfully assess HIT readiness.

Survey procedure questionnaires are typically used for survey research, to determine the current status or “situation” (Diem, 2004). The main aim of conducting surveys in this research study is to collect numerical data to test hypotheses formulated from the developed preliminary HIT readiness framework.

The constituent sections of this chapter detail the rationale for the use of a quantitative method. This is followed by the basis for the questionnaire/instrument, validating, pilot-testing by operationalizing the three main research questions. This involves: (1) identifying main theoretical concepts; (2) elaborating and sorting these into a list of aspects, which provide the constituents for (3) drafting a solid survey questionnaire and the actual operationalization of the questionnaire instrument (Ersanilli et al., 2011). During the review of literature in Chapter 2, the main theoretical concepts were identified. The identified concepts were each explored during the collection of rich qualitative data in order to identify aspects of the concepts (variables). During the analysis of the rich qualitative data measures or elements of the aspects emerged which helped determine the impact of the aspects on the main theoretical concepts. These steps served as the framework, which has been used throughout this research process.

8.1 Case study methodology

This case study sought the views of clinical[27] and non-clinical officers[28] from KATH on the readiness of their institution to successfully expand on their HAMS system and/or implement other potential HIT related systems after systematic literature review and qualitative study involving heads of HIT from various public hospitals and leaders of HIT/e-Health related projects in Ghana quantitative study in this last phase. Case study methodology includes a range of data gathering methods (Yin, 2013). Central to the case research design in this study was the decision to include one or several cases in the project (Benbasat et al., 1987). Given that newly developed indicators/measuring tools for HIT/e-Health readiness assessment were being tested for their reliability and the fact that research on HIT/e-Health readiness of this magnitude has never taken place in Ghana, it was deemed that single site study was appropriate. This case study included quantitative data with results of initial analysed qualitative data being input in

27 Medical doctors, pharmacists, RNs, Lab technicians
28 Administrative officers

developing survey instrument. The survey was timely as it provided a broad overview of the views of both clinical and non-clinical staff on the implementation of HAMS and hatching the idea extending its functionalities and/or implementing other HIT systems.

This study began with the collection of data from KATH in Kumasi, the capital of the Ashanti region of Ghana from March to April 2017 using a survey instrument developed from an initial thematically analysed collected qualitative data.

The primary survey approach used in this research was the traditional in-person distribution of paper-based questionnaire, popularly known as drop and collect survey (DCS). It is the one data collection technique that appears to avoid most of the shortcomings of the other survey methods including on-line, telephone and postal in developing countries. By combining the strengths and avoiding the weaknesses of face-to-face and postal surveys, DCS provides a fast, cheap and reliable research tool (Brown, 1987). Each statement in survey was ranked on a Likert scale of 1 – 5 (1 = No, never considered; 2 = No, but have considered; 3 = Yes, in progress; 4 = Yes, nearly completed; 5 = Yes, in place). All clinicians and non-clinicians (administrators) at the KATH were invited to participate in the study. Information about the research study was posted on permissible notice boards of KATH. The researcher also met and spoke to about 200 potential participants prior to the actual distribution of the survey questionnaires as part of creating awareness.

8.1.1 Komfo Anokye Teaching Hospital (KATH)

Founded in 1954 and located in Kumasi, (refer to Figure 8.1 below, map of Ghana for the location of KATH) the capital of the Ashanti Region, Ghana, KATH is the second-largest hospital in Ghana (Govindaraj et al., 1996) and the only tertiary health institution in the Ashanti Region. As the second largest referral hospital in Ghana, KATH served and still serves as the main referral hospital for the Ashanti, Brong Ahafo and northern regions of Ghana. It has a bed capacity of about 1000 and is affiliated to the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi. KATH was selected for two reasons: 1) previously implemented a Telemedicine centre with the support of the Indian government; and 2) currently planning to extend the functionalities of the Health Administration Management System (HAMS).

The HAMS captures and tracks information about patients with a view to monitoring sources of revenue generated at the hospital more efficiently. It was also designed to computerize operational activities in the hospital and induce medical staff to improve their output and operational efficiency to pave the way for quality healthcare delivery and enhance revenue generation. The leadership of KATH, in collaboration with the IT department, are planning to expand the tools of HAMS to capture patients' health information electronically. When the plans are completed/implemented and the extended HAMS is in operation, patients will no longer have different folders holding their information within various departments.

Figure 8.1, map of Ghana for the location of KATH

CardioStart International (2014))

8.1.2 Quantitative method and justification

In the literature, it was found that the nature of IT requires a dynamic approach that will help investigate rigorously its rapidly evolving nature. This study adopted mixed methodology as mentioned in Chapter 4. The mixed methodology used was the sequential use of first qualitative data leading to quantitative data collection. During the application of qualitative data collection approach in phase two of this research, a one-on-one interview was conducted with heads of IT in various public hospitals in Ghana, lecturers in the field of health informatics and biostatistics and leaders of HIT initiatives in Ghana. Themes generated from the analysis of the qualitative data collected and findings from the review of literature in Chapter 2 were used as key inputs in developing an instrument for the survey to collect quantitative data on the views of clinical and non-clinical staff towards the confirmation and adoption of the preliminary model developed in Chapter 7.

Quantitative research is a type of research that `explains phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics)' (Sukamolson, 2010). There are several types of quantitative research apart from survey research, which include correlational research and causal-comparative research, given however, given the overall aim of this research, however a survey quantitative survey research approach was deemed appropriate. This was because survey research uses scientific sampling and questionnaires designed to measure characteristics of the population with statistical precision. In the context of this study, a survey questionnaire was used to measure the extent to which clinical and non-clinical staff of KATH believe they were getting ready to implement a HIT system they have been working on. Firstly, the main advantage for the administration of the survey questionnaire in the settings of this study was its convenience for participants, allowing them to be more independent in expressing their views. Secondly, because it was paper-based with in-person distribution within an institution, collection was easy and timesaving as it was easy to locate participants by going to their work places. The greatest disadvantage of the administration of the paper-based survey was the high cost of photocopying in Ghana.

8.1.3 Instrument development process

In developing the survey instrument for this research study, the "the step-by-step guide to developing effective questionnaires" suggested by Diem (2004) was adapted because it provides simple guidelines with the potential to develop an effective survey instrument.

8.1.3.1 Determining the purpose

In planning for this research instrument there was a need to determine the purpose and how the data collection would be utilized. The purpose of the survey/questionnaire was to test the pre-determined hypotheses and produce generalizable results to confirm the developed model in Chapter 7. Much contemplations took place regarding the consequences of administering this instrument and whether the information sought from this questionnaire could have been obtained from existing sources in the form of secondary data in lieu of conducting a survey. Given that the use of IT in delivering health care in Ghana (as in other third world countries) is still in its infancy, there was a need for primary data collection from institutions and individuals involved in one way or any other with IT in the healthcare environment. Furthermore, the limited availability of literature and industry reports on the development of IT in the healthcare industry made colleting first hand data indispensable in this research study.

8.1.3.2 Deciding what to measure

As with defining the purpose of the survey exercise, elements to be measured were derived from both literature reviewed and the analysis of the qualitative data collected in the second stage of the research process. The elements to be measured as constructs of the model developed in Chapter 8 from the analysis of the qualitative data were grouped into two: *healthcare organizational readiness* and *environmental readiness.* These two mother constructs had various sub-constructs or components. The sub-constructs or variables of organizational readiness identified from the analysis of the qualitative data and from the review of literature are *core, engagement and buy-ins, change management, value proposition, technology, finance, reimbursement, and workforce*. In order words organizational readiness was broken into these variables to help measure it as a construct of HIT adoption readiness. To ensure the survey instrument developed was appropriate for the population, “a field test” was conducted with potential respondents and HIT practitioners. The test confirmed the relevance of all constructs and questions but suggested the need for modification in terms of paraphrasing some questions. This helped in further clarification of ambiguous statements/sentences. Furthermore, following the recommendations of Diem (2004) regarding questionnaire design and wording of questions helped to reduce systematic “measurement” error, which in effect improved the internal validity of this study. A modified version of the questionnaire was distributed to both clinical and non-clinical officers of KATH for the second phase of the data collection for this research study.

In the blue print instrument, there were 82 questions in total for eleven (11) predictors of three (3) main constructs. This translated into the number of questions per construct range of 4 – 8. In total, each participant was given a ten (10)-page document including an introduction letter (cover page) and participant’s information and consent form/information. Anecdotally, healthcare providers (in particular medical doctors) do not like participating in other researches. That proved unfounded in this research as participants were keen to know how the outcome of this study might help to find clues to improve HIT implementation in public hospitals as one specialist relates: *“I like your topic. We have been struggling to implement some of these* *systems for the past five years"* (DROPP). This statement proves the relevance of the content of the instrument and the entire research study to the healthcare community in Ghana.

8.1.3.3 Survey questionnaire and style of questions

After the exploratory phase, two key steps were considered critical to be completed before the task of designing the questionnaire should commence: the first of these was the need to articulate the questions that this research study is intended to address; and the second step was to determine the hypotheses around which the questionnaire is to be designed (Crawford, 1997). This research study was expected to develop an HIT adoption readiness assessment model for public hospitals in Ghana. This is in the context of factors, which promote HIT adoption readiness and factor that are seen to be impeding the HIT adoption readiness of public health facilities, as well as trying to determine whether any relationships exist among the promoting and inhibiting factors.

As with the view of Prasad et al. (2001), the hypotheses in this study were clear statements of what was intended to be investigated and they were specified from the research questions before the commencement of this research. There were four in all. They have since been broken into more easily-testable hypotheses derived from the developed initial readiness assessment model. For instance, hypothesis one was purported to be investigating/testing the existence of factors that promote the IT readiness of public hospitals in Ghana for e-Health adoption where the independent variable there was 'e-Health adoption'. In determining the hypotheses around which the questionnaire was to be designed, it was felt necessary to revisit the hypotheses generated from literature review and theories. There are no fixed rules about how to design a questionnaire. However, the recommendations offered by Crawford (1997) played an important role in designing the questionnaire for this study.

It was composed of three parts. The first part revealed participants' background – gender, their institution, number of working years, etc. The second part of the questionnaire used Likert scale measures of organizational healthcare and environmental readiness towards the adoption of IT. In choosing measurement scale and scoring, Diem (2004) recommended which scales that provide the necessary information and are appropriate for respondents be used. In the case of this research study, a *Rating Scale*, to be precise, the *Likert scale* was deemed appropriate. This is because Likert Scale questions use a universal technique of collecting data, which makes it easy to understand. Working with quantitative data, as is the case in this study, it will be easy to draw conclusions, reports, results and graphs from the responses. Furthermore, because Likert Scale questions use a scale, respondents were not forced to express any opinion that had the potential to fall outside the dimensions of this study. This was also meant to help them to be neutral when they answer the questions. During the preparation of the questionnaire items, the research population as an audience were kept in mind through the following:

1. To make this questionnaire an effective one, respondents were provided with the context for the questions by announcing the topic and defining the timeframe for events or behaviours that are to be included in the response in the first section of the questionnaire;

2. The questionnaire was designed well enough to meet the objectives of this research to minimise the problem of leaving some essential questions unanswered;

3. The questionnaire was developed in such a manner that it had the potential to obtain the most complete and accurate information possible. To achieve this the questionnaire was reorganised and reworded after the pilot study to encourage respondents to provide accurate, unbiased and complete information by asking them to rank on a scale of 0-5 to the best of their ability the relevant issues pertaining to the HIT readiness of KATH;

4. The questionnaire was also designed to make it easy for respondents to give the necessary information and for the interviewer to record the answers with minimal errors. This was achieved through a three-section design and the arrangement of the questions.

8.1.3.4 Structure and content of the questionnaire

In this research study, the structure of the questionnaire was divided into three essential sections: the introduction; biographic; section and questions. As recommended by Frehill et al. (2006) the cover letter was used wisely and it helped increase trust with respondents, and therefore response rates. The questionnaire included context and preamble. This was because an effective survey question provides the respondent with a context for the question by announcing the topic and explaining what the respondents were being asked to do (e.g., check one, list all). In this questionnaire, respondents were asked to rate (0-5) statements using the scale provided **(0 = Don't Know/NA; 1 = No, never considered; 2 = No, but have considered; 3 = Yes, in progress; 4 = Yes, nearly completed; 5 = Yes, in place)** in the corresponding spaces provided. Based on the recommendations made by Thayer-Hart et al. (2010) and Diem (2004), any concepts or terms that the respondent needed to understand in order to answer the question were defined. As much as possible plain English language was used. Every effort was made to avoid jargon as well. It was also felt that including simple relevant graphics that depict the purpose and setting of the research was necessary to easily draw the attention of respondents to the research domain.

The next section collected basic information about participants, which included gender, name of work institution, current position and number of years of practice or service at their current institution.

The third section contained the questionnaire, which had items and scales of measurement directly related to the research question and the hypothesis and provided places for participants with spaces for answering. To provide participants with a flow to the questionnaire related questions were put together in various sections in accordance with the over-arching themes derived from the initial analysed qualitative data to make answering more logical. There were *Core readiness; Organizational cultural readiness; Value proposition readiness; Operational resource readiness; and Regulatory* and *policy readiness.*

The outcome of the analysed qualitative content analysis and thematic analysis are classified under the qualitative descriptive design (Vaismoradi et al., 2016), techniques used to analyse textual data and expound theme (Jacoby and Siminoff, 2008). The questions, therefore, contained in the survey instrument were related to Table 6.4 in Chapter 6. Table 8.1 below details the sample labels used in SPSS and their matching hypotheses.

Table 8.1: Variables, SPSS labels, operational definition, scale and corresponding hypothesis

Variable	SPSS label	Operational definition	Measure	Relevant hypothesis
Core readiness	Planning	0 = Don’t know 1= No, never considered 2 = No, but have considered 3 = Yes, in progress 4 = Yes, nearly completed 5 = Yes, in place	Ordinal	H1
Engagement and buy-ins	Engage	0 = Don’t know 1= No, never considered 2 = No, but have considered 3 = Yes, in progress 4 = Yes, nearly completed 5 = Yes, in place	Ordinal	H2

Source: Developed for this study

8.2.1 Research sample

Sampling is an important component of any piece of research for gathering data about the population in order to make an interpretation that can be generalized to the population in question. The quantitative research paradigm emphasizes the importance of generalizability and reliability (Henn, Weinstein & Foard 2006). There are three aspects of sample size for the administration of a questionnaire. They are: sampling frame[29]; sample size; and sample selection (Fowler Jr, 2013). Obtaining a sample size that is appropriate in both regards is critical for many reasons in this research. Most importantly, a large sample size in the case of quantitative data collection is more representative of the population, limiting the influence of outliers or extreme observation (Patel et al., 2003). The sample for this study (see Table 8.3 below) was drawn from the target population[30] of practising doctors, nurses, and hospital administrators of KATH[31], in Ghana. The decision to use this population was taken as a result of the fact that the population in question was believed to have the required knowledge necessary to participate in this research study, i.e. involvement in various e-Health initiatives in Ghana including a preliminary implementation of e-Health systems in the above mentioned participating hospitals. In addition to their knowledge about e-Health, previous small-scale e-Health research studies have used a similar sample including (Achampong, 2012, Adjorlolo and Ellingsen, 2013, Afagbedzi et al., 2013, Afarikumah, 2014, Sarfo and Asiedu, 2013). The initial plan was to invite all healthcare providers (medical doctors, registered nurses and administrators at KATH to participate in the study). The table below details the size of the target population. Given the paucity of literature on HIT in developing countries, in particular Ghana, there was a need for careful and effective recruitment strategies for the acquisition of appropriate and valid data. In this research study for example, some proactive recruitment strategies were used to obtain a credible response rate for this survey high enough to sustain external validity. This required an approach that persuaded the research population that it was worth their time to participate (Parkinson et al., 2015).

[29] A list or map that identifies most units within the target population WILMOT, A. 2005. Designing sampling strategies for qualitative social research: with particular reference to the Office for National Statistics' Qualitative Respondent Register. *SURVEY METHODOLOGY BULLETIN-OFFICE FOR NATIONAL STATISTICS-*, 56, 53.

[30] In this study, a set of elements larger than the population sampled and to which the researcher would like to generalize study findings.
[31] Plans are underway to implement e-Health systems in KATH

Table 8.2 Research sample

Distribution of sample	Location	Sample	N0.	No. Participated
Komfo Anokyi Teaching Hospital	Kumasi	Doctors	500	49
		Nurses/Lab Tech	2000	158
		Administrators	300	91
Total			2800	298

Source: Developed for this study

8.2.2 Ethical approval and survey administration

As a rule of thumb, the USQ requires Ethical approval for all research involving humans and animals prior to the commencement of any data collection. For this research, too, ethics application was made to the USQ Human and Ethics application committee and was granted, **H13REA149.** To collect quantitative data (conduct surveys), most healthcare facilities would require researchers to be granted ethics approval. The later stage of this research, validation of this model for hypotheses testing at KATH, required the grant of ethical approval. An application was made to KNUST/KATH ethics committee and approval was granted, **CHRPE/AP/119/17**.

8.2.3 Pilot study and results

Before the administration of the survey on a full scale, a pilot study was firstly undertaken with 20 prospective participants who were attending a workshop. Pilot studies are often recommended by scholars and consultants to address a variety of issues, including preliminary scale or instrument development. Specific concerns such as item difficulty, item discrimination, internal consistency, response rates, and parameter estimation in general are all relevant (Johanson and Brooks, 2010). To conduct an effective pilot study, the researcher targeted situations or occasions that brought the research population together such as workshops. In a workshop of 25 participants for clinicians and non-clinicians, the researcher successfully negotiated with a facilitator to allow 10 minutes to hold a pilot study session. Participants were made up of medical doctors and senior nurses as well as administrators. The pilot study aimed to seek their views on the relevance of the content of the questionnaire for any improvement.

Participants, together with the researcher went through the questionnaires on a rating scale of

0 to 3, where 0 = not good, 1 = good, but need revision, 2 = generally good, 3 = very good in the context of content relevance, clarity and completion of questionnaire within reasonable time.

Eighteen (72%) out of the 25 participants put up their hand for 2 = generally good while 7 (28%) felt that it the questionnaire items were good in terms of content but needed some revision in the context clarity of questionnaire statements.

A number of participants, particularly healthcare providers noted that they might not have sufficient time to complete the questionnaire. They further noted that the risk of taking a little longer time to complete the questionnaire was related to lack clarity/hard-to-understand questionnaire statements. Fifteen others noted that there was place for “Don’t know” for questions they didn’t know.

The researcher noted that ambiguity in questionnaire statements was central to matters arising from the pilot study. The researcher then reviewed the entire questionnaire in the context of sentence construction, whilst maintaining the purpose of affected questionnaire statements. The researcher felt it was more important to collect the valid data with the most appropriate participants than to review the entire questionnaire to suit the interest of the masses at the expense of valid data. Help was sought from industry HIT practitioners for review and paraphrasing or rewording some of the questions in order to make sure it was clear and easy for participants to understand. The researcher also added “0 = Don’t know” to the scale of ranking.

8.3 Full scale and actual administration of survey

The constraint of time, the nature of Ghanaian postal services, and the busy working nature of respondents were immediate factors that were considered prior to the administration of the survey. With these thoughts in mind, the researcher decided it would be appropriate and effective to travel in person to the research site. It was also deemed that personal distribution of paper-based survey questionnaires to respondents by the researcher at the research site would be the most convenient, cost effective, and reliable approach. Normal driving time from Accra to Kumasi is 6 hours. The following steps were taken to administer the survey.

Firstly, the researcher liaised with heads of various directorates for general information about the departments and the appropriate time to approach staff. These directorates included *Anaesthesia and intensive care, Child health, DEENT, Emergency medicine, Obstetrics and* *gynaecology, Oncology and polyclinic, Surgery, Trauma and orthopaedics, Pharmacy, and General administration.*

Distributing the questionnaire to participants was based on their availability and willingness. The researcher briefly introduced himself and briefed prospective participants about the study. Given that the patient-doctor ratio in Ghana sat at 1:10,170 in 2013 nationally (Quaicoe-Duho, 2015), which falls far below the WHO revised standard of 1:600, the researcher understood the pressures under which healthcare providers work. Prior to the distribution of the questionnaire, the researcher had research awareness notices placed on permissible notice boards. Many of the questionnaires were returned to common desks for collection between 3-5 days after distribution.

The researcher also targeted a number of ongoing workshop/training and development programs that brought healthcare providers and administrators together. There were five workshops, which took place during the period of the data collection. The researcher again requested and was granted permission to do a group explanation about the research and distribute questionnaires to interested participants. Participants who took the questionnaires returned them to the facilitators at the end of the next days' workshop sessions for collection.

To make sure the respondents in this research were not intimidated, the questionnaire started with non-threatening questions. This was because opening questions that are easy to answer, not perceived as being "threatening", and are perceived as being interesting, can greatly assist in gaining the respondent's involvement in the survey and help to establish a rapport (Crawford, 1997).

8.3.1 Response rate

Conducting successful survey research among organisational populations is, at the best of times, tasking and challenging (Ibeh and Brock, 2004). The primary goal of this survey was to gather quantitative data on the perspectives of clinical and non-clinical officers at KATH on preparations towards the implementation of the new HIT system (Extended HAMS). Poor survey response rates from healthcare practitioners, however, previously observed (Parkinson et al., 2015). This is no surprise given that there is a shortage of healthcare professionals globally. This offers healthcare professionals very little time for other things including participating in research. Furthermore, there is no doubt that, with particular reference to surveys in developing countries, the usually slow and unreliable postal system and the relatively poor standard of research support infrastructure (Goodyear, 1982, Mytton, 1996) affects both participation and sincerity. It is beyond the scope of this research to provide extensive information about the various approaches to increasing response rates among healthcare providers.

The primary survey approach used in this research was the traditional in-person distribution of a paper-based questionnaire, popularly known as drop and collect survey (DCS) at KATH. The DSC method is the one data collection technique that appears to avoid most of the shortcomings of the other survey methods including on-line, telephone and postal without sacrificing their benefits. In conducting the DCS, the researcher would carry the survey questionnaire to various directorates/departments of KATH and personally talk to potential participants. Prior to talking to participants and distributing questionnaires, the researcher, in addition to the grant of ethics would talk to the relevant persons in charge of the departments for any necessary departmental/directorial procedures. Participants' motivation through initial awareness creation, effective introductory part of the survey questionnaire that introduces participants to the research topic, a brief explanation of the research and straightforward questions also played a major role in increasing response rate. The self-administered questionnaire allows a single researcher to gather data from a large, representative sample of respondents, at relatively low cost per datum.

8.3.2 Method of Analysis

Quantitative data analysis is helpful in evaluation because it provides quantifiable and easy to understand results. In choosing the appropriate method for the analysis of the quantitative data gathered, the researcher consulted with the USQ statistical services for guidance.

8.3.3.1 Data preparation and entry

Data preparation commenced once the questionnaire was being developed. The questionnaire for the collection of quantitative data for this research study was developed in a manner that allowed well-organized data to be collected, then for easily entered. The questionnaire was peer reviewed with relevant stakeholders – individuals and groups with relevant knowledge in both industry and academia, taking into consideration the appropriate method of analysis to be used out of the myriad of quantitative data methods available.

The questionnaire for the collection of data was paper-based. As such during the entry of answers, particular attention was paid to multiple answers provided for one question and related errors. The only collected was that required for this study as the questionnaire made no provision to accommodate any other data to be collected or added to the required data such as personal views. The data was meticulously entered into an MS Excel spreadsheet with entry of relevant variables. The data in the Excel file was later properly set up in IBM SPSS Version 23. In the SPSS file of the data, in "Variable" view, all relevant "Labels" were put in and all "Measure" changed to "Scale" for all except the first variable (Participants). The data was screen with the help of the "Analyze" tool through descriptive statistics and frequencies in order to have a further look at the data for possible elimination of errors.

8.3.3.2 Missing values

In surveys, missing values occur when no answer or data value is provided for the variable in statement (Allison, 2012). Missing values are an almost unavoidable incidence in survey research and can have a noteworthy effect on the conclusions that can be drawn from the data. In this research study, the missing values occurred because of nonresponse, a situation in which no information was provided for one or more items or for a whole section. The other reason was due to drop out, which occurred leading to some questionnaires being returned with no a single answer provided.

In this research study, while respondents did not have to provide reasons for not providing answers to selected individual or groups of questions or not completing the entire questionnaire, the researcher loosely attributed the presence of missing values in this data to the nature of the work of the respondents, healthcare providers. Due to the shortage of healthcare providers, in particular doctors, in Ghana and most other parts of the world, doctors are always under pressure and hardly give time at work to participate in activities other things other than patients' care. Secondly, some participants may have difficulty in providing answers to some particular answers for reasons best known to them. Throughout this data, 12 instances of missing data were observed with the help of the SPSS descriptive analysis tool, which generated an output to that effect and were deleted. Deleting missing values was recommended by (Tabachnick et al., 2001).

8.3.3.3 Validity and reliability

Reliability and validity are ways of demonstrating and communicating the rigor of the research processes and the trustworthiness of research findings (Roberts et al., 2006). In this research study, the pursuit of this trustworthiness commenced with the literature review in the domain of HIT in the context of developing countries with experiences of cases drawn from developed countries as well. From the literature, two main concepts (*organizational readiness and environmental readiness*) or constructs/themes were found to be impacting the adoption of HIT in developing countries. As such, the determination of the readiness of public hospitals in Ghana to adopt HIT was based on the measurement of these concepts in a quantitative study, after they were found to be relevant in an initial qualitative study. Based on this argument, *Validity* is defined as the extent to which a concept is accurately measured in a quantitative study (Heale and Twycross, 2015).

The measurement of these concepts was based on concepts derived from qualitative data analysis to make sure sub-concepts were accurately measured. Heale and Twycross (2015) also defined *Reliability or the accuracy of an instrument* as the extent to which a research instrument consistently has the same results if it is used in the same situation on repeated occasions. Reliability was also assured in this research by the fact that instruments measuring the main concepts were also derived from the discussion of variables relating to the main concepts found in the qualitative data. In other words, the instrument measuring the variables adequately covers all the content that it should with respect to the variable. The instrument does this by covering the entire domain related to the variable (or construct) it was designed to measure and assuring content validity. Furthermore, the implication of construct validity enshrined in this study was that of being able to draw inferences about test scores relating to the organizational readiness and environmental readiness concept/constructs being studied.

If research is to be helpful, it should avoid misleading those who use it (Roberts et al., 2006). One way of doing this and strengthening validity was through peer review of the instrument (Cavana et al., 2001) to ensure that all questions asked were relevant and that scales used in seeking the answers were consistent. To achieve a higher degree of construct validity, (i.e. to make sure that the questions actually measure what this research study intends them to measure), each aspect needs to be measured by several questionnaire-items (i.e. questions). For instance, Planning had seven (7) questions, engagement and buy-ins had eight (8) questions.

8.3.3.4 Statistical techniques employed

The measuring tools for the variables were the key concepts that emerged from the thematically analysed qualitative data. As a result factor analysis was expected to be used to drive the concept that measurable and observable variables can be reduced to fewer latent variables that share a common variance and are unobservable, which is known as reducing dimensionality (Bartholomew et al., 2011). Factor analysis is a multivariate statistical approach commonly used in psychology, education, and more recently in the health-related professions (Williams et al., 2010). This was meant to summarise data so that relationships and patterns among variables could easily be interpreted and understood. In previous Chapters, 6 and 7, constructs were identified, with accompanying variables and their measures. Prior to any analysis, the researcher undertook the following:

Data screening was conducted to make sure the working data was free of anomalies using the Analyse, descriptive statistics and frequencies tools of SPSS and generated output in order to get rid of any anomalies.

The researcher began to conduct Univariate statistics in order to have a fair knowledge of how the data was playing out for analysis – factor analysis.

The following SPSS Version 23 statistical tools and techniques were also employed

1. Descriptive statistics
2. Correlation analysis
3. Validity and reliability
4. Chi test
5. *t*-Test
6. Test of differences
7. Regression analysis

8.4 Matters arising from the data collection exercise

The following issues arose during the administration of the survey questionnaires.

- As the second largest teaching hospital in Ghana and the fourth in the sub-Saharan African region, it was difficult to engage participants as they were busy for most of their working shifts
- Collection of distributed questionnaire became difficult especially with the clinicians (doctors and nurses) as their working shift kept changing.
- Some questionnaires could not be collected due to changes in working shifts of some participants.

8.5 Chapter limitations

As noted above, both the distribution and collection of the questionnaire was extremely difficult given the size of the Komfo Anokey Teaching Hospital (KATH) and the busy nature of clinicians working within it. Furthermore, the lack of ample time for an adequate explanation of the questionnaire to participants due to their busy schedules led to the inability of the researcher to collect all distributed questionnaires.

8.6 Conclusion

This chapter has provided in detail the processes involved in the quantitative data collection. It has discussed all the strategies employed to maximise response rates given the nature of the data collection environment. Chapter 10 presents the analysis of the collected quantitative data.

CHAPTER 9: QUANTITATIVE DATA ANALYSIS

Overview

Chapter 8 discussed in detail the processes and the strategies employed in collecting the quantitative data (administration of survey questionnaires) including questionnaire/data error mitigation strategies such as a pilot study.

This chapter presents various tests/analyses carried out on the data collected in the preceding chapter, from clinical and non-clinical staff of Komfo Anokye Teaching hospital (KATH). Descriptive analyses, factor analysis and regression analyses will be employed in an attempt to analyse the data as well as the testing of formulated hypotheses.

9.0 Introduction

Quantitative data analysis in this research study began with data entry into an Excel spreadsheet and later properly set up in IBM SPSS Version 23. Data was first screened for cleaning to ensure there were no errors in entry and that proper labelling and values were entered correctly. In the SPSS, descriptive analyses were conducted for getting rid of any anomalies through using the "output generated". In particular, attention was paid to demographic information (gender, current position, number of working years and profession) and to the data itself. To perform factor analysis in this study a check was undertaken for presence of univariate normality within the data. The analyses were conducted using descriptive statistical tools, which included frequencies and valid percentage reports, cross tabs and Chi-Square for various associations in order to gain some kind of understanding of the data. In the sections below, aspects of the description of the analyses are presented.

9.1 Data preparation

The following aspects of the data were dealt with as part of pre-data analysis activities

9.1.1 Missing data

When missing data are deleted, a researchers' best approach will be to assume the data did not exist. The proportion of missing data is directly related to the quality of statistical inferences (Dong and Peng, 2013). From the literature regarding inferences there is no established acceptable percentage of missing data in a data set for valid statistical cut off. For example, Schafer (1999) is of the view that a missing rate of 5% or less is negligible. In a related context, Bennett (2001) contends that when the amount of missing data are large (greater than 10%) the results of subsequent statistical analyses may be biased. In the data for this study, Variable "TechInfra 8.1" had 18 missing values, which was equivalent to 6% of participants not answering it. As a result, it was excluded from the data for further analysis.

9.1.2 Dealing with Outliers and (multi) collinearity

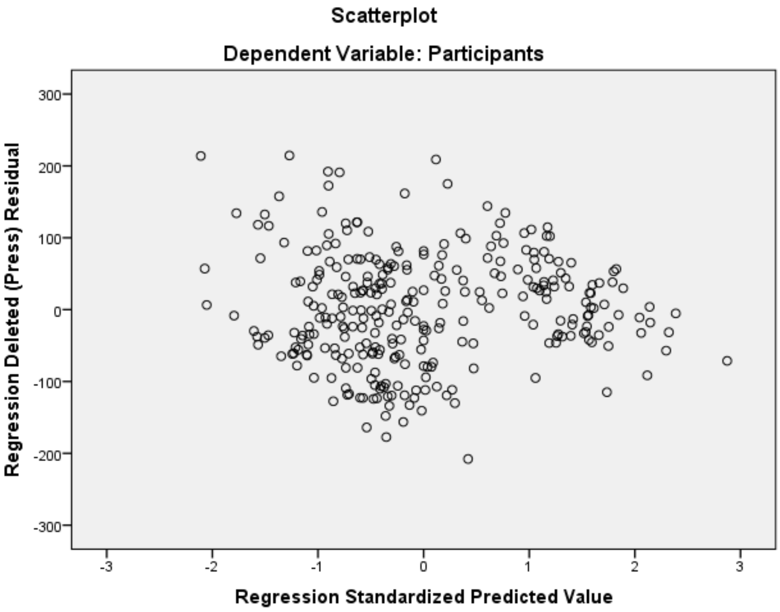
In SPSS, an initial regression analysis procedure was conducted as a technique to identify outliers. The basis for multivariate outlier detection is the Mahalanobis distance (Filzmoser, 2004). Prior to this, data screening was conducted to make sure there were no data entry errors. In this study multivariate outliers are defined as observations having a large (squared) Mahalanobis distance (Filzmoser, 2004).Thus, those individuals (Cases) with a p-value less than 5% ($p > 0.05$) or a quantile of the chi-squared distribution of 95% were considered outliers. 66 outliers were identified. The next step was the examination of the characteristics of the outlying individual. The findings from this observation did not find any special characteristics relating to the outliers. Although some authors such as (Orr et al., 1991) argue that the removal of extreme scores produces undesirable outcomes especially when the outliers are legitimate, according to (Osborne and Overbay, 2004), they are in the minority. Additionally, as noted by Geert van den Berg (2015), correlations are very sensitive to outliers; a single unusual observation may have a huge impact on a correlation. In this case the outliers did have an impact through the presence of multicollinearity. Based on the cut-off points offered by Stevens (2012) and Hair et al. (2006), the data with the outliers suffered from multicollinearity. Conceptually, there are strong arguments for the removal or alteration of outliers and as such they were removed (Ibid). In this study, the researcher, however, could not make an early decision on whether to remove outliers or not. Instead, he thought it prudent to create two data files, one with outliers and the other without outliers and to continue analysing them and monitoring their outcomes.

Later in the stages, (multi) collinearity among variables proved acceptable levels. Multicollinearity exists when two or more of the predictors in a regression model are moderately or highly correlated (PennState Eberly College of Science, 2017). According to the Collinearity Statistics output from SPSS, the Tolerances for individual variables were in the range of 0.166 and 0.340, greater than 0.10 while the variance inflation factors, VIF (1/Tolerance) for individual variables were between 2.702 and 6.038, less than 10.

9.1.3 Homoscedasticity

Homoscedasticity among variables was assumed when the output of a scatterplot produced random scattered variables in dots as could be seen in Figure 9.1. The assumption of homoscedasticity (meaning "same variance") is central to linear regression and describes a situation in which the error term is similar across all values of the independent variables (Statistics Solutions, 2017). Linear regression will rarely be a problem when the goal is to assess the effects of independent variables on the outcome (Lumley et al., 2002). In this analysis, the objective was to examine the extent of the variance of questionnaire distribution. The variance, squared standard deviations (SD^2) of all items ranged between 1.090 and 1.556. While the SDs of items remained in the range of 1.091 and 1.250, the means (M) ranged between 3.07 and 3.52, an indication of well or normal distribution among variable measuring items.

Figure 9.1: Homoscedasticity



Source: SPSS Output

9.2 Descriptive statistics

Descriptive statistics is the term given to the analysis of data that helps describe, show or summarize data in a meaningful way such that, for example, patterns might emerge from the data (Laerd Statistics, 2013a). The following sections describe some of the statistics in this research study.

9.2.1 Demographic

As per the structure of the survey instrument, the second part was meant to collect participants' background information, also known as demographics. Participants were expected to provide information concerning their gender, number of working years, and current position. The objective of seeking demographic information was to find out in later stages whether there were any relationships between participants' background and their involvement in HIT projects in their institutions. See Table 9.1 for details:

Table 9.1: Gender distribution of participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	129	43.3	43.7	43.7
	Female	166	55.7	56.3	100.0
	Total	295	99.0	100.0	
Missing	System	3	1.0		
Total		298	100.0		

Source: SPSS output

The output from the descriptive analysis from Table 9.1 indicates that more females, 166 (56.3%) participated in the research as opposed to 129 (43.7%) males.

9.2.2 Treating "0 = don't know" as Latent or Unobserved

"*Don't know, 0*" was treated as unobserved during the descriptive analyses of various aspects of the data at the time of describing participants' demographics associated with answers provided to each questionnaire statement. According to Allison (2012) if data are missing on a variable for *all* cases, then that variable is said to be latent or unobserved. This was because the focus of this study was to investigate the progress that was made so far by the case hospital, KATH against a set of statements identified from the analysis of the initial qualitative study and in the literature, to influence successful HIT implementation. It was deemed, therefore, that zero (0) might not contribute towards getting a clear picture of the preparations that were being made towards the implementation of the imminent HIT system.

Table 9.2: Participants' position/professional distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Nurse	126	42.3	43.6	43.6
	Lab Tech	29	9.7	10.0	53.6
	Medical Dr/Pharmacist	46	15.4	15.9	69.6
	Administrator	88	29.5	30.4	100.0
	Total	289	97.0	100.0	
Missing	System	9	3.0		
Total	298	100.0			

Source: SPSS output

The frequency/percentage of the position table above relating to participation in this study is a true reflection of the nurse/doctor ratio (43.6%/15.9%) at KATH, which is a common pattern in Ghana and in other developing countries. According to literature and other industry reports, there is a general shortage of healthcare professionals, in particular medical doctors. At KATH, like in many healthcare centres, there are more nurses than medical doctors or physicians. Hence, more nurse participants in this study than any other group. In Ghana, the doctor to patient ratio was 1:10,170 in 2013 nationally (Quaicoe-Duho, 2015). This put a lot of pressure on medical doctors/physicians. Relatedly, technology vendors are engaging nurses with IT backgrounds to help them execute successful EHR installations, knowing that nurses are key users of patient data (Herman, 2014). Three per cent (3%) of participants did not fill in their profession/position.

9.2.3 Working years

This study relates to healthcare organizational readiness towards the adoption of HIT. The number of working years at KATH in the context of experience is believed to play a key role given that the level of experience has the potential to manifest in organizational culture and attitudes of end-users towards any proposed changes and HIT is no exception. As a result, the table below provides information about participants' working years.

Table 9.3: Years of work at KATH distribution of participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 5 years	144	48.3	48.8	
	6 - 10 years	107	35.9	36.3	
	11+	44	14.8	14.9	
	Total	295	99.0	100.0	
Missing	System	3	1.0		
Total		298	100.0		

Source: SPSS output

According to the SPSS Output in Table 9.3, participants in category 1 (1-5 working years) had a frequency of 144, which translates to a valid 48.8% and were the majority of participants in this research. Category 2 (6-10 years) were the second largest group to participate in this study with a valid 36.3%. 298 people participated in the study with three (3) missing in the system. This result appears to imply that participants who were still somewhat new had an interest in seeing some form of HIT development taking place to help them with their work. People with a longer working history appeared not to have such a keen interest in these development, perhaps because they might be close to retirement as one senior nurse asserted during the distribution of the questionnaires: "*I have been working here for long and due to pension soon so I do not see the need for this*". There is currently a lack of research focused on investigating the potential relationship between length of working years in the healthcare environment and attitude towards acceptance and use of HIT by employees of healthcare facilities. Unlike studies investigating the readiness of healthcare providers (Saleh et al., 2016), length of working years was not a requirement of this study since the focus was organizational readiness.

Table 9.4: Mean and Standard Deviation differences

		Gender	Position	Working category
N	Valid	295	289	295
	Missing	3	9	3
Mean		1.56	2.33	1.66
Std. Deviation		.497	1.307	.724

Source: SPSS output

The analyses of the independent variables Gender, Position and Working years, labelled as "Working category2" appear to be demonstrating agreement of distribution. Thus, the Mean (M) for the above variable were *Gender* = 1.56, *Position* = 2.33, and *Working years* = 1.66. In the same context, the Standard Deviations (SD) distribution were also within agreement. The SD for *Gender* = 0.497, *Position* = 1.307, and *Working years* = 0.724.

Other analyses that were conducted using various crosstabs had to do with association of working years and positions of participants with various factors of readiness of HIT at KATH.

9.2.4 Descriptive analysis using Chi-Square under cross tabulation

When conducting survey analysis, cross tabulation provides an appropriate way of analysing and comparing the results for one or more variables with the results of another (or others) (Wyse, 2012). In this research study, Chi-Square under cross tabulation descriptive analysis was used to help understand the relationships between questions/factors and participants' demographics (gender, working years and position) in the context of detecting any statistically significant difference in the way the aspects of demographics have influenced the pattern in which the questionnaires were answered. As a result, a confidence level of 95% was assumed with a critical value or an error probability P-value of <0.05 implying that the variance of answers with a $\rho < 0.05$ were deemed statistically significant. To quantify the strength of evidence against null hypothesis, Fisher (1925) advocated for $P < 0.05$ (5% significance) as a standard level for concluding that there is evidence of a hypothesis. Many IT studies including Gökalp (2010) and Pablos (2013) have also used the 5% ($\rho < 0.05$) significant level. The variance of the following questions in the questionnaire were found to be significant these are presented in Table 9.5 below:

Table 9.5: Chi-Square working years/individual question association analysis

No.	Question	Chi-Square (X^2)	Pearson Value
1	1.1 A formal strategic planning	26.549	0.01*
2	4.5 Standard and consistent record keeping method	17.955	0.022*
3	5.5 The organization has determined ROI	17.876	0.022*
4	6.1 NHIS HIT covered services to be reimbursed	19.594	0.012*
5	9.5 Technology service quality (availability)	16.798	0.032*
6	10.1 Installation time	17.171	0.028*
7	12.1 Practitioner licensing requirements	16.892	0.031*
8	12.1c. Difference in requirements in consulting	15.540	0.049*
9	12.4 Regulations on national HIT delivery	17.527	0.025*
10	13.2 Additional authorization and security	17.323	0.027*
11	14.1 Existing policies, standards, and procedures	19.724	0.011*

* *Asymptomatic significant values ($\rho < 0.05$)*

Source: SPSS output

A full cross tabulation analysis was conducted for working years and ranking of individual items in the questionnaire. The objective was to investigate any association between the number of working years of participants and the pattern of ratings of questionnaire items. Tabulated outputs of Chi-Square analysis indicate that ratings of 11 questionnaire statements among participants differed significantly. The output also appears to suggest that participants who have been working for 11 years or more seemed to be more informed about the state of HIT preparation at KATH. The number who provided answers to various questions ranged from 0% – 3% for scale # 3, "*No, but have considered*" to 14% – 19% for scale #5, "*Yes, near completion".* There were 43 participants who had 11 or more working years at KATH out of the 302 participants. A similar pattern was observed in the answers provided by participants in the 6-10 working year's group. This group was, however, more abreast with information about e-Health while participants with 1-5 working years appeared not to know much about progress being made towards the implementation of the system. The 1-5 working years was the major participating group. Each question item was answered by an average of 280 participants. The analysis also produced 11 (14%) question items out of 77 items with asymptomatic significant values, thus, $\rho < 0.05$ demonstrating homogeneity in the way the questions were answered.

Table 9.6: Chi-Square Position/individual question analysis

No.	Question	Chi-Square (X^2)	Pearson Value
1	1.3 Identification of specific/a range of clinical/or behavioral health services	29.174	0.04*
2	1.6 National IT coordination office	21.631	0.042*
3	1.7 IT governance	26.829	0.008*
4	2.2 Evidence of process used to engage community stakeholders	25.346	0.013*
5	2.6 Identification of internal /external champions	21.354	0.045*
6	3.1 Staff involvement in technology selection	21.499	0.044*
7	3.3 Availability of change leaders	25.305	0.013*
8	4.2 Technology support org clinical goals	25.006	0.015*
9	4.3 Consideration of cultural issues	23.315	0.025*
10	4.7 Referral system in place	26.494	0.009*
11	5.1 Cost/benefit analysis	22.686	0.031*
12	9.2 Service delivery technology meeting requirement	21.095	0.049*
13	10.1 Installation time	23.870	0.021*

* *Asymptomatic significant values ($\rho < 0.05$)*

Source: SPSS output

Another full Chi-Square was conducted in an attempt to gain an insight into any potential association or links between participants' positions and how the questionnaire statements were ranked/answered. An analysis of SPSS output tables generated, suggest that Administrators were more informed about the progress of HIT projects. This outcome was not surprising given that most non-clinical activities in healthcare facilities would normally be managed or carried out by hospital administrators including the management leadership team. In a related study Harmsen and Royle (2017) named leadership as an important organizational management component relevant for the implementation of HIT. With an average of 84 administrators ranking each statement, the average number that ranked "*No, never considered*" ranking #2, ranged between 3 and 9. The analysis also shows that that rankings of 13 questionnaire statements among participants differed significantly, which is in the same range as 11 in the case of "working years' and "questionnaire statements". This implied that the pattern of answers provided for 13 statements out of 77 item statements were asymptomatic significance, equivalent of $\rho < 0.05$ with a maximum of three (3) statements from affected variables.

While in the case of "*position*" and "*question statements*" analysis, three (3) statements/questions each from the variables "Planning" and "Value proposition" were ranked significantly different, the variable "Regulatory" had three (3) statements ranked significantly different for Chi-Square "*working years*" and "*questionnaire statements*" analysis.

When cross-tabulating participants' "*Working years*" with "*question statements*", twenty per cent (20%) of participants with 11 years' or more experience believed Q1.6 and Q1.7 have "*Never been considered*" on the one hand. On the other hand, 5.5% indicate "*Yes, completed*" while 30% believed "*No, but have considered*" respectively. Large numbers seem to be around the "*no*". In the same context, "*position*" cross-tabulated with "*question statements*" produced a similar result with Q1.6 where 25% of nurses, 22.2% of administrators, and 19% of doctors/pharmacists were recorded in the "no" ranks whereas 10%, 4% and 12% of administrators, nurses and doctors/pharmacists indicate "*Yes, completed*". Again, the majority appears to be in the "*no*" category.

A further descriptive analysis was conducted to verify if participants' "position" and "working years" differed using cross tabulation. The result, Pearson Chi-Square value of 5.542 and corresponding asymptomatic significant value of 0.476 (ρ > 0.05) indicate there was no significant difference among participants in the context of "position" and "working years". This result further affirms that participants did not differ in their answers provided in the backgrounds of position and working years as illustrated in the paragraph above.

9.3 Reliability and validity

Prior to this SPSS reliability test, an initial content validity test was conducted with prospective participants in a workshop. On average, out of the 25 participants, on a 0 to 3 scale, 18 (72%) felt the questionnaire was generally good by putting up their hands for 2 = generally good.

Reliability essentially means consistent or dependable results and reliability is a part of the assessment of validity (Sullivan, 2011). In this research study as with many others, it was necessary to establish reliability. Cronbach alpha from the SPSS procedure was used in the calculation to establish reliability. Cronbach alpha calculates correlation among all the variables, in every combination; a high reliability estimate should be as close to 1 as possible and generally 0.7 (Sullivan, 2011). Cronbach alpha is a test of internal consistency used to calculate the correlation values among the answers on your assessment tool (Bland and Altman, 1997).

In verifying the reliability of the data for this study, all 77 questionnaire items in the survey instrument were used to create a combined variable. The value of Cronbach's alpha for the composite variables in the context of the initial framework is near to 1 (0.989) as shown in Table 9.7. Two (2) items (1.6 and 1.7) were found not to be relevant from an initial factor analysis, so they were deleted.

Table 9.7: Summary of reliability statistics

No. of cases	Description	Cronbach's Alpha	No of Items
302 (with outliners)[32]	Full item reliability	0.987	77
232 (without outliers)[33]	Full item reliability	0.989	77

Source: Developed for this study

9.4 Exploratory factor analysis

Factor analysis (FA) is used in many fields such as behavioural and social sciences, medicine, economics, and geography as a result of the technological advancements of computers (Yong and Pearce, 2013).

The exploratory factor analysis steps suggested by Williams et al. (2010) were adapted because they provide a concise means of conducting factor analysis. For this research study the steps adapted were:

9.4.1 Ensuring the data was suitable for factor analysis

While a lack of agreement over the ideal sample size for factor analysis exists, as a general guide incl300 cases (Tabachnick et al., 2001); 100 or greater (Hair et al., 2006) and 100 might be considered poor, 200 fair, 300 good, 500 very good, and 1000 or more as excellent (Comrey and Lee, 2013). In this research study, the sample size of 302 was deemed ‘good’ according to the above guideline. In this research study FA is used to identify factors relevant to HIT adoption readiness among public healthcare organizations in Ghana using KATH as a case study and also identify the underlying relationships between manifest variables (Norris and Lecavalier, 2010). Furthermore, in the context of this study exploratory factor analysis (EFA) was used because there appears to be little supporting evidence for the factor structure and the goal here was to identify the number of common factors and the pattern of factor loadings (Norris and Lecavalier, 2010).

9.4.2 Deciding how the factors will be extracted in the context of rotational method

32 Before outliers were removed
33 After outliers have been removed

There are many factor extraction methods but those commonly used in factor analysis include Principal components analysis (PCA), Principal axis factoring (PAF), Maximum likelihood Unweighted least squares, Generalised least squares, Alpha factoring and Image factoring (Pett et al., 2003, Williams et al., 2010). The aim of the data extraction in this research study as with many others was to reduce a large number of items into factors. In order to produce scale unidimensionality and simplify the factor solutions, several criteria are available to researchers (Williams et al., 2010).   As (Thompson, 2004) noted, PCA is the default method in many statistical programs, and thus, is most commonly used in EFA. Like Thomson, Pett et al. (2003) also recommended PCA in establishing preliminary solutions in EFA. As such, PCA was deemed the appropriate rotation method for this research. Furthermore, given that there was no priori theory or model (Gorsuch, 1983) in the context of measuring tools for HIT adoption readiness factors for public healthcare facilities in Ghana, PCA emerged as the favourite factor for the rotational method.

9.4.2.1 Selection of rotational method

Rotation is used to further analyse initial PCA or EFA results with the goal of making the pattern of loadings clearer or more pronounced and the process is designed to reveal the simple structure (Brown, 2009). Rotation methods are either orthogonal or oblique. Simply put, *orthogonal rotation* methods assume that the factors in the analysis are *uncorrelated* (Brown, 2009). Given factors were believed to be uncorrelated, orthogonal, to be more precise Varimax rotation was deemed appropriate for this research.

To enable this to occur, SPSS software Version 23 was used to reduce the number of measuring factors of variables in order to get rid of unrelated factors. This was done using the "Principal Component" and "Varimax" rotation techniques. Even though there was no limitation to any number, "Maximum Iteration for Convergence" was limited to 0.5 under the "Rotation".

9.4.2.2 Factor analysis

A factor analysis of the collected survey data from KATH was performed using the Principal Component Analysis (CPA) method of extraction. In the analysis Kaiser-Meyer-Olkin (KMO) was 0.968 and Bartlett's test of sphericity X^2 (1953) = 15612.70, which is the measure of sampling adequacy and P value of 0.000 ($p > 0.05$) suggesting that the strength of the relationships among variables was high. Consequently, it was acceptable to continue with the analysis.

A series of factor analyses were conducted including parallel analysis. A Parallel Analysis (Eigenvalue Monte Carlo Simulation) conducted extracted only three (3) (see Table 9.8 below).

Table 9.8: Parallel Analysis (Eigenvalue Monte Carlo Simulation): Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1	42.5	2.5	2.6
2	4.1	2.3	2.4
3	3.2	2.2	2.3

Source: Developed for this study

Parallel Analysis is a Monte Carlo simulation technique that supports researchers in determining the number of factors to retain in Principal Component and Exploratory Factor Analysis (Ledesma and Valero-Mora, 2007). Generally, parallel analysis extract fewer components/factors.

As conventional to SPSS, a Varimax rotation was performed repeatedly on 64 factors. The final result was a five (5)-components extraction with a minimum of 5 loadings per factor with eigenvalues greater than 0.5 gave the most interpretable solution. See Table 9.9 below for the summary of the total variance explained (TVE) and Table 9.10 for the obtained pattern matrix and summary of extracted components and factor loadings. Only items with factor loadings of 0.5 and above were included.

Table 9.9: Summary of Total Variance Explained

Component	Initial Eigenvalues			Extracted Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumm %	Total	% of Variance	Cumm %	Total	% of Variance	Cumm %
1	36.4	57.8	57.8	36.4	57.8	57.8	14.3	22.7	22.7
2	3.9	6.2	64.0	3.9	6.2	64.0	10.9	17.4	40.1
3	2.6	4.1	68.1	2.6	4.1	68.1	9.4	14.9	55.0
4	2.0	3.2	71.3	2.0	3.2	71.3	6.8	10.8	65.9
5	1.5	2.4	73.8	1.5	2.4	73.8	4.9	7.7	73.6
6	1.0	1.7	75.4	1.0	1.654	75.4	1.2	1.8	75.4

Source: SPSS Output

The first component, 1 was strong, with a high eigenvalue of 36.422, an equivalent of 57.8% of the variance in the data. Component 2 had an eigenvalue of 3.918 and accounted for another 6.2% of the total variance. The eigenvalues for components three and four were 2.586 and 2.016 (4.1% and 3.2%) respectively. The last component had an eigenvalue of 1.525, which accounted for a further 2.4% of the total variance. These components had fewer items loaded onto them with mid-ranged loading factors, which affected their variance.

The proportion of each variable's variance which can be explained by the retained factors in the context of communalities in this analysis, were high enough to be considered for further analysis. The "Initial" of each extracted variable was 1.000 while the "Extraction" value ranged between 0.638 and 0.839 respectively.

Table 9.10: Rotated component matrix of factor analysis

Items/Indicators	TR	OCR	ORR	RPR	CR	HITR
The types of HIT have been scrutinized, in terms of the functionalities.	**.766**					
The hospital has identified the medical requirements that have to be met using the HIT.	**.746**					
The practical viability of the selected HIT has been considered, such as user friendliness of the system for both patients/providers.	**.735**					
The hospital has assessed the need of the HIT for the serving population	**.730**					
The hospital has examined the HIT to be implemented in the context of workflow improvement/simplification.	**.728**					
The chosen HIT is interoperable with existing systems in the hospital and being examined in the context of other healthcare facilities/agencies.	**.714**					
The availability of reliable Internet has been determined.	**.712**					
The hardware and software required for the selected HIT technology is available for purchase.	**.712**					
The cost of the hardware and software required for the selected HIT technology would be reasonable	**.708**					
The service delivery technology/device has been discussed/selected/purchased and tested.	**.704**					
The service delivery technology/device will meet the hospital’s needs for delivering client/patient services.	**.698**					
Issues of HIT system quality have been discussed/resolved.	**.677**					
Issues of HIT information quality have been discussed/resolved.	**.671**					
Issues of HIT service quality have been discussed/resolved	**.664**					
Issues of HIT system use have discussed/resolved	**.664**					
Issues of user satisfaction have been discussed/resolved	**.630**					
Information about deployment plans has be made known to relevant stakeholders.	**.623**					
The hospital has determined when the system would be implemented.	**.612**					
A training session for end-users on using the HIT technology is in place.	**.609**					
There is a plan to keep stakeholders informed on the progress of the system deployment.	**.596**					
End users (doctors, nurses, administrators) are being consulted throughout the HIT preimplementation process		**.772**				
The hospital has established process used engaging all stakeholders.		**.748**				
The hospital has identified other interested hospitals collaborators.		**.746**				

The HIT initiative has been supported by members of the board of directors		**.732**				
The HIT initiative has been supported by management leadership		**.723**				
All relevant champions have been identified		**.706**				
Reliable communication channels have been established		**.695**				
There are plans for creating awareness		**.666**				
All relevant stakeholders have been participating in all relevant implementation plans		**.649**				
The hospital has successfully implemented related systems previously		**.648**				
Leaders to foster change management among all stakeholders have been identified and they are known		**.648**				
All relevant change management teams have been put in place and they are known		**.644**				
There are plans to manage/deal with anticipated changes to be brought about by the HIT system deployment		**.640**				
There are measures in place to collect and evaluate feedback from users		**.638**				
The hospital has conducted analysis on the cost/benefit of using HIT services.			**.733**			
Relevant tools for HIT usage for both care providers and care receivers/patients have been identified			**.728**			
Continued costs of operating the system have been projected/determined.			**.723**			
Situations have been developed to test repayment of services delivered through HIT.			**.711**			
The hospital has determined any projected return/savings on the investment			**.695**			
The hospital has investigated which services have been covered by the National Health Insurance (NHI) can be delivered by e-Health technologies			**.684**			
Issues of payment for services delivered through HIT have been resolved			**.669**			
Issues of eligibility requirement for repayment by NHIS has been determined			**.659**			
The hospital has determined the availability of the system (sites) for both the general public and care providers			**.625**			
There are enough skills to successfully implement the HIT system			**.603**			
Individual and collective roles have been determined			**.601**			
IT staff are happy to implement the system			**.601**			
The is a reasonable level of acceptance among users			**.600**			
Plans are in place to train staff on using the HIT technology to be implemented.			**.598**			
Issues of liability in the use of the technology has been determined				**.750**		

The selected e-Health services conform to the NHIS covered scheme/services				**.737**		
There is available guideline on the use of the technology				**.711**		
Measures are in place to conform to changing HIT regulations				**.708**		
Points (sites) of HIT services identified and requirements being examined.				**.665**		
The chosen HIT to be implemented meet the regulatory framework available				**.626**		
There are regulation permitting the use of the chosen technology				**.622**		
The chosen HIT practices are in line with information protection acts				**.604**		
Patient electronic data protection measures are in place				**.561**		
An official document outlining HIT implementation plan is in place.					**.817**	
A need assessment including special health characteristics and needs of the population has been performed.					**.801**	
HIT supported services have been determined.					**.738**	
Staff with relevant knowledge/skills are available.					**.729**	
Evidence on the practical effectiveness of HIT and lessons learned has been drawn					**.703**	
In the context of Core Readiness (CR) for HIT we are ready						**.649**
In the context of Organizational Cultural Readiness (OCR) for HIT we are ready						**.729**
In the context of Operational Resource Readiness (ORR) for HIT we are ready						**.699**
In the context of Regulatory Policy Readiness (RPR) for HIT we are ready						**.664**
In the context of Technological Readiness (TR) for HIT we are ready						**.832**

Extraction Method: Principal Component Analysis (PCA)
Rotation Method: Varimax with Kaiser Normalization

A factor analysis of the HIT readiness assessment items used in the current study suggested 5 factors were appropriate to expound the perception of employees of KATH on HIT readiness. The pattern matrix in Table 10 revealed factor 1 consists of 20 items relating to technology. This factor was named *Technological readiness* which demonstrated a high internal consistency. The second component consisted of 15, items all of which related to human resource and funding and was labelled *Resource readiness*. Component 3 contained 14 items relating to views about stakeholder engagement and issues of change management and was consequently named *Organizational cultural readiness*. The fourth component was made up of nine (9) items, all of which were related to HIT policy and regulatory framework and as such was named *Regulatory and policy readiness*. The fifth component, made up of 5 factors relating to planning was labelled *Core readiness*. Overall, the factor analysis of the HIT readiness assessment items revealed that from all items with the same response scale, nine (9) items did not load onto any component. These items related the determination of value proposition. A further single item was excluded because it had more than 5% missing values.

Table 9.11: Composite variables and reliability items

No.	Component Description	Measuring Items	Cronbach's Alpha
1	Technology readiness	Q7.1 – Q7.5, Q8.2 – Q8.5, Q9.1 – Q9.8, Q10.1 – Q10.3,	0.975
2	Organizational Culture	Q2.1 – Q2.8, Q3.1 – Q3.6, Q4.1, Q4.3	0.961
3	Operation al resource readiness	Q5.1 – Q5.6, Q6.1 – Q6.4, Q11.1 – Q11.6	0.944
4	Regulatory & policy readiness	Q12.2 – Q12.4, Q13.1, Q13.2, Q14.1 – Q14.4	0.961
5	Core readiness	Q1.1 – Q1.5	0.886
6	HITR	Q15.1 – Q15.5	0.868

Source: SPSS output

Using the data reduction technique, the reliability of the composite variable (component) was established. As can be seen in Table 9.11 above, the Cronbach's alpha values of the eight (8) components (0.981-0.824) prove the strong interrelatedness between measuring items. As suggested by Tavakol and Dennick (2011) a low value of alpha could not only be done to a small number of questions, but also as a result of poor interrelatedness between items. The debate about the acceptable values of alpha is ongoing. There are different reports, however, about the acceptable values of alpha, ranging from 0.70 to 0.95 (Bland and Altman, 1997, DeVellis, 2016).

Internal consistency is concerned with the interrelatedness of a sample of test items, whereas homogeneity refers to unidimensionality (Tavakol and Dennick, 2011). In this research, after a rotated component matrix was conducted, related measuring items were regrouped, which helped in improving the interrelatedness of the sample of test items. As a way of further confirming the established reliability of items, an interclass correlation for composite (ICC) variable was also conducted. Interclass correlation is the usual linear (Pearson product-moment) correlation among a set of pairs of values when the order in each pair is arbitrary (Taylor, 2010).

Table 9.12: Interclass correlation analysis

Variable description	Single[34] measure	Average measure[35]	Significant value
Technology readiness (TR)	0.665	0.975	0.00
Organizational Culture readiness (OCR)	0.636	0.961	0.00
Regulatory & policy readiness (RPR)	0.652	0.944	0.00
Operational resource readiness (ORR)	0.619	0.961	0.00
Core readiness (CR)	0.609	0.886	0.00
HITR	.569	.881	0.00

Source: SPSS output

It can be inferred from the table above that factors loaded under each component were actually measuring the component given that P-values ($p > 0.05$) were significant and single measure values for each component were lower than the average measure.

9.4.3 Correlation analysis

In order to assess any significant relationship between the composite variables, a Pearson product- momentum correlation (Pearson r) was conducted. The Pearson product-moment correlation coefficient (or Pearson correlation coefficient, for short) is a measure of the strength of a linear association between two variables and is denoted by *r* (Laerd Statistics, 2013b). The variables were being measured on a ratio scale, which is a prerequisite for using Pearson correlation. The Pearson product-moment correlation coefficient is a dimensionless index, which is invariant to linear transformations of either variable (Lee Rodgers and Nicewander, 1988).

[34] The estimator is the same, whether the interaction effect is present or not.
[35] This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Table 9.13 Correlation analysis for the identified composite variables from factor analysis

		TR	ORR	OCR	RPR	CR
TR	Pearson correlation	1	0.800**	0.774**	0.743**	0.471**
	Sig. (2-tailed		0.00	0.00	0.00	0.00
ORR	Pearson correlation	0.800**	1	0.669**	0.709**	0.424**
	Sig. (2-tailed	0.00		0.00	0.00	0.00
OCR	Pearson correlation	0.774**	0.669**	1	0.690**	0.424**
	Sig. (2-tailed	0.00	0.00		0.00	0.00
RPR	Pearson correlation	0.743**	0.709**	0.690**	1	0.519**
	Sig. (2-tailed	0.00	0.00	0.00		0.00
CR	Pearson correlation	0.471**	0.424**	0.641**	0.519**	1
	Sig. (2-tailed	0.00	0.00	0.00	0.00	

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

Source: SPSS output

With reference to Table 9.13, all variables exhibited a positive relationship (r values were all positive) in the range of 0.4** to 0.8** and $p > 0.05$ for all, suggesting the contribution of these composite variables towards the assessment of *HIT adoption readiness* of KATH, as a dependable construct. The *r* value, the correlation between TR and ORR was 0.8. According to Stevens (2012) and Hair et al. (2006), to have a significant relationship between variables, the r value would have be at 0.8. As a result, the correlation between TR and ORR was deemed to being significant in this analysis.

9.4.3.1 Screening composite variables for multicollearity

An examination of a set of data for the existence of multicollinearity should always be performed as an initial step in any multiple regression analysis (Mansfield and Helms, 1982). As can be seen from Table 9.13 above all *r* values for independent variables were within the acceptable range. As mentioned above, the correlation between TR and ORR appeared to be strong but still met the threshold suggested by Stevens (2012) and Hair et al. (2006), which was for the *r* value to exceed 0.8.

9.4.3.2 Mean and Standard deviation differences by respondent characteristics

An independent samples *t*-test was conducted to compare and verify if any evidence existed to suggest that responding population differed in any way in relations to their working years. There was no significant difference in the scores for working years: Male (M=7.22, SD=6.1) and Female (M=7.26, SD=4.5) with t (223) = -.051, p = 0.959. Gender and Profession: Male (2.93, SD=1.2) and Female (M=2.89, SD=1.2) with t (221) = 6.417, p = 0.000. These results suggest that while the number of working years of participants has no significant impact on gender in the context of the healthcare organization's readiness for HIT; position/profession did have an effect on perception of HIT readiness in healthcare institutions. Likewise, there was no significant difference between genders in response to various composite variables.

Table 9.14: Summary of test of differences of Mean, Standard deviation (SD) and t-value differences by respondent characteristics

	Gender	No.	Mean	SD	t-value	df	Sig (2-tailed)
Working years	Male	100	7.22	6.1	-0.051	233	0.959
	Female	125	7.26	4.5			
Profession	Male	99	2.93	1.2	6.417	221	0.000
	Female	124	1.89	1.2			
TR	Male	94	67.96	19.6	0.33	208	0.809
	Female	116	67.05	19.6			
OCR	Male	96	47.32	13.84	0.242	211	0.739
	Female	117	46.88	1284			
ORR	Male	95	52.72	14.57	13.96	209	0.164
	Female	116	49.80	15.58			
RPR	Male	96	31.31	8.68	19.35	212	0.054
	Female	118	29.00	9.00			
CR	Male	96	17.49	5.02	0.508	216	0.612
	Female	122	17.16	4.66			
HITR	Male	94	43.59	11.08	0.882	201	0.379
	Female	109	42.22	10.90			

Source: SPSS output

9.4.3.4 Test of differences for composite variables

Furthermore, a One-way between subjects' profession/position and working years ANOVA were conducted to compare their effect on various composite variables or factors for any significance. Output from SPSS suggests there was no significant difference between working years of participants and individual composite variables. From the summary Table 9.16 below, it can be seen that there were significant effects of participants' working years on RPR [F (32, 181) = 2.082, P = 0.001], $P < 0.05$ and CR [F (20, 196) = 1.871, P = 0.016], $P < 0.05$. Post hoc tests, however, were not performed for Working years because at least one group has fewer than two cases.

Table 9.15: Summary of test of differences between respondents' profession and working years

			df	F	Sig.
CR	Working yrs	Between Groups	20	1.871	0.016
		Within Groups	196		
	Profession	Between Groups	20	1.206	0.253
		Within Groups	195		
HITR	Working yrs	Between Groups	100	1.342	0.071
		Within Groups	102		
	Profession	Between Groups	99	1.06	0.377
		Within Groups	102		
OCR	Working yrs	Between Groups	42	1.102	0.326
		Within Groups	170		
	Profession	Between Groups	42	1.03	0.438
		Within Groups	169		
ORR	Working yrs	Between Group	52	1.062	0.380
		Within Group	158		
	Profession	Between Groups	51	1.060	0.384
		Within Groups	157		
RPR	Working yrs	Between Groups	32	2.082	0.001
		Within Groups	181		
	Profession	Between Groups	32	1.161	0.268
		Within Groups	179		
TR	Working yrs	Between Groups	59	1.159	0.213
		Within Groups	158		
	Profession	Between Groups	59	0.966	0.495
		Within Groups	149		

Source: SPSS output

9.5 Regression analysis

Linear regression is a general method for estimating/describing as association between a continuous outcome variable (dependent) and one or multiple predictors in one equation (Abdel-Salam, 2008). In this research study, linear regression was used to predict the dependent variable, HITR based on values of the independent variables (TR, OCR, ORR, RPR, and CR) through the enter procedure in SPSS version 23. Effectively, the intention was to be able to understand the unique contribution of each variable towards predicting/or assessing the overall HIT readiness (HITR) of healthcare institutions intending to implement an HIT. All variables were being treated as metric level (interval and ratio). As with general linear regressions, *R* was used to measure the correlation between the predicted values and the observed values. *R* *squared* (R^2) is the square of the coefficient and specifies the percentage of variation explained by the regression out of the total variation whereas "*Adjusted R squared*" gives an idea of how the model generalises in the context of validity.

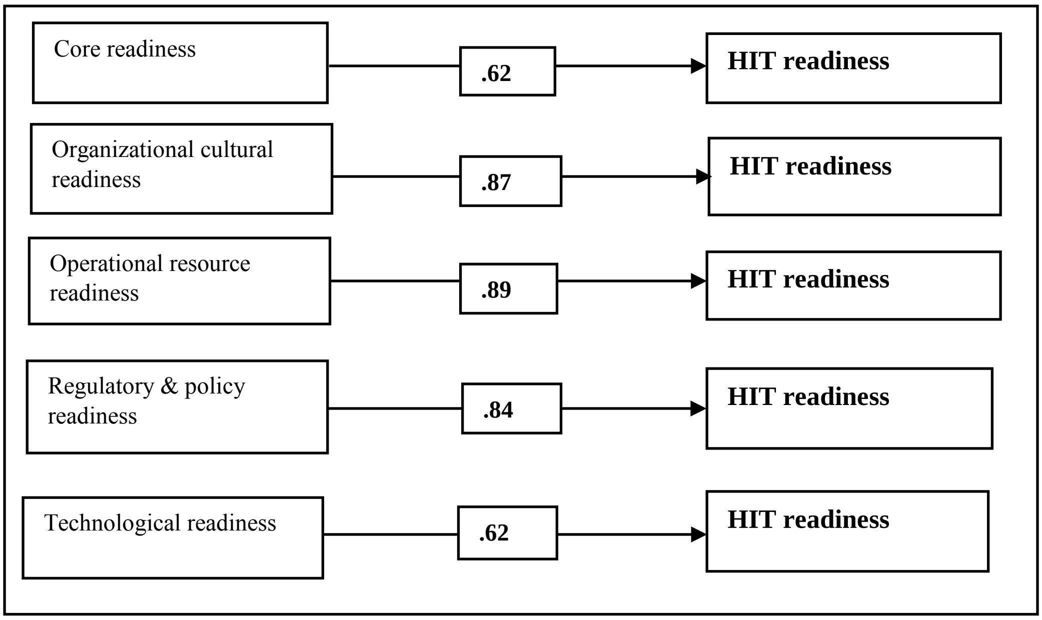
Ideally, it is desirable that its value is as close as possible to the value of "R squared" (Bradley, 2007). In this research study, the beta (B) regression coefficient was computed to allow the researcher to make such comparisons and to assess the strength of the relationship between each predictor variable to the criterion (dependent) variable. In the Table 9.17 below, an attempt has been made to summarise the analysis. As can be seen, each of the composite variables is positively and significantly correlated with the criterion (dependent) variable. The correlation coefficient for all the predictors (TR, OCR, ORR, RPR, and CR) to the criterion variable, HITR ranged from 0.62 to 0.94, whereas the R^2 ranged from 0.38 to 0.88. This implied, for instance, that, 87.9% of variation in the HITR is explained by Technology readiness (TR) as a predictor of HITR ($R^2 = 0.879$). In the same context, 37.5% of variation in the HITR is explained by Core rediness (CR) as a predictor ($R^2 = 0.375$). Effectively, the significance values of 0.00, $P < 0.05$ for all predictors and the Beta values all confirm the significant contributions made by the predictors in the analysis.

Table 9.16: Summary of linear regression analysis of composite variables to dependent variable

			HITR					
Composite variables	R/Beta value	R^2	Adjusted R^2	DF	Sig value	B value	t-value	Sig value
TR	0.938	0.880	0.879	1, 209	0.00	0.518	39.121	0.00
OCR	0.871	0.758	0.757	1, 212	0.00	0.703	25.762	0.00
ORR	0.886	0.785	0.784	1, 210	0.00	0.629	27.659	0.00
RPR	0.835	0.697	0.696	1, 213	0.00	1.003	22.153	0.00
CR	0.615	0.378	0.375	1, 217	0.00	1.355	11.485	0.00

Source: SPSS output

Figure 9.2: Linear relationship between independent variables and the dependent variable (HITR)



Source: developed for this study

9.5.1 Multiple regression

The linear regression analysis conducted earlier has confirmed the strong relationship that existed between the independent and the dependent variables, giving the impetus for multiple regression to be conducted.

Table 9.17: Multiple regression analysis between independent and dependent variables

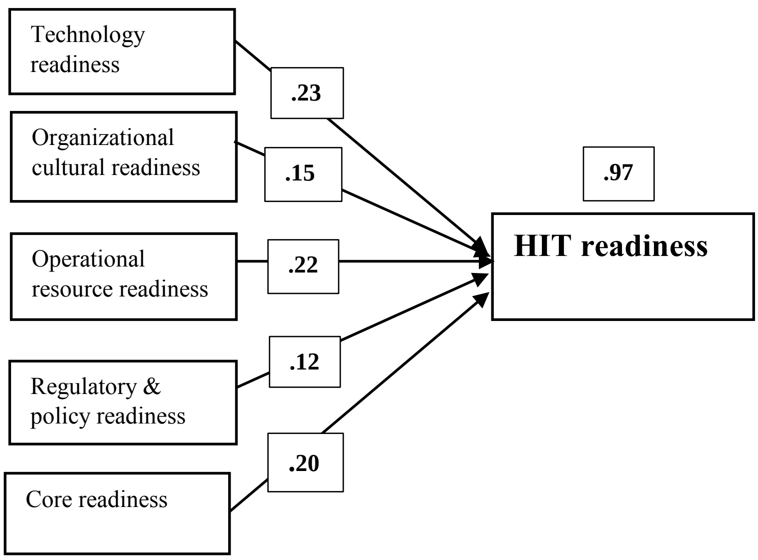
	Dependent Variable			
Independent variables	B value	βeta value	t-value	P-value
TR	0.233	0.422	17.268	0.00
OCR	0.152	0.308	8.135	0.00
ORR	0.219	0.188	15.135	0.00
RPR	0.118	0.098	4.770	0.00
CR	0.199	0.090	5.623	0.00
	$R^2 = 0.971$; F (5, 214) = 1414.303			

Figure 9.2 presents the final adoption model, including standardised path coefficients, their significance, and the amount of variance explained (R^2). The multiple regression model with

all five predictors produced $R^2 = 0.971$. The F statistics had degrees of freedom of 5 and 214 [F (5, 214) = 1414.303], $P = 0.00$ $P < 0.05$. These results suggest that 97.1% of the variance in the HITR is explained by all five predictors combined (TR, OCR, ORR, RPR, and CR) confirming a strong relationship between the criterion variable and the predictor variables. Consequently, it can be inferred that the multiple correlation coefficients were significant. Furthermore, the implication of these results as can be seen from Table 9.18 above, TR had a t value of 17.3, $P = 0.00$ $P < 0.05$; OCR, t =8.1, $P = 0.00$ $P < 0.05$, ORR with t of 15.1, $P = 0.00$ $P < 0.05$; RPR had a t value of 4.8, $P = 0.00$ $P < 0.05$, while CR had a t value of 5.6, $P = 0.00$ $P < 0.05$. The model's R^2 of .971 demonstrates that the model explains a great amount of variance in eHealth adoption by KATH. Consequently, it can be concluded that all five predictor variables explaining 97.1% of the variance in the HITR, uniquely contributed to the regression equation and ultimately to the determination of HITR, as a dependent variable.

Thus, the standard coefficient of multiple regression analysis was used to describe the association between the dependent variable, HITR and the independent variables (Technology readiness, Organizational cultural readiness, Operational resource readiness, Regulatory and policy readiness and Core readiness). This implies that these independent predictor variables and their measuring instruments can actually be used to assess the HITR of healthcare organizations. Figure 9.2 below, is the actual/complete readiness assessment model ready for adoption.

Figure 9.3: Second phase HIT readiness assessment model



Source: Developed for this study.

9.5.2 Testing hypotheses

In Chapter 7, where initial HIT readiness assessment was developed following the analysis of qualitative data, six (6) hypotheses were formulated. However, one of the identified factors, *Value proposition readiness* failed to load during the exploratory factor analysis, leaving five (5) initial formulated hypotheses. The hypotheses formulated were meant to investigate whether there were relationships between predictor (independent) variables (TR, OCR, ORR, RPR and CR) and the dependent variable (HITR). These relationships were tested using SPSS multiple regression tools.

Based on this analysis, the initial hypotheses formulated in Chapter 7 were analyzed further. Refer to Table 9.19 for a summary of the analysis of the hypotheses.

Table 9.18: Summary analyses of hypotheses formulated for this study

Hypothesis	Description	Significant value	Acceptance/rejection
Hypothesis 1	Technological readiness will have direct impact on the HIT readiness of KATH.	$P < 0.05$ $t = 17.23$ $\beta = 0.422$	Accepted
Hypothesis 2	Organizational and cultural readiness will have a significant impact on the HIT readiness of KATH.	$P < 0.05$ $t = 8.14$ $\beta = 0.303$	Accepted
Hypothesis 3	Resource readiness will have direct impact on the HIT readiness of KATH.	$P < 0.05$ $t = 15.14$ $\beta = 0.188$	Accepted
Hypothesis 4	Regulatory and policy readiness will have direct impact on the HIT readiness of KATH.	$P < 0.05$ $t = 4.80$ $\beta = 0.098$	Accepted
Hypothesis 5	Core readiness will have a minimal impact on the HIT readiness of KATH.	$P < 0.05$ $t = 5.62$ $\beta = 0.090$	Accepted

Source: Developed for this study

9.6 Initial conclusion

In this chapter, initial descriptive analyses were conducted on different cases to help understand the initial pattern of the data and to verify whether there were any significant differences in the way different cases in terms of gender, working years and profession answered the questionnaires. With Cronbach's alpha value set at 0.05 in all analyses in SPSS, various internal consistencies were measured. Chronbach's alpha values in this research study were high, indicating high internal consistencies among constructs and within (intra) items measuring constructs/composite variables. The PCA factor extraction method alongside the Varimax rotation method were used to extract and rotate the factors in EFA. Furthermore, a one-way between subjects' profession/position and working years ANOVA was conducted to compare their effect on various composite variables or factors for any significance. The SPSS output did not show any significant differences among the groups. In later analyses, regression (linear) and multiple regression were conducted on the independent variables (TR, OCR, ORR, RPR and CR) against the dependent variable *HIT readiness*. Findings suggest that the independent variables could indeed be used in determining *HIT readiness* of healthcare organizations.

The next section presents the procedure and findings from the structural equation modeling techniques employed in order to assess the fitness, predictive relevance of the model developed and to confirm the outcome of the initial analyzed hypotheses.

9.7 Employment of second generation (2G) statistical techniques

As opposed to first generation (1G) techniques such as correlations, regressions, or difference of means tests (e.g., ANOVA or t-tests), second generation (2G) techniques structural equation modeling (SEM) offers extensive, scalable, and flexible causal-modeling capabilities beyond those offered by 1G techniques. A 2G statistical technique such as SEM allows for holistic testing of multistaged models and is better at establishing causation and representing the complex network of causal links necessary for establishing causation to be in accordance with the theoretical model (Lowry and Gaskin, 2014). As basic limitations (see Table 9.20 below), linear regression, assumes no measurement error and makes no assumption for indirect effects. In this research study, conducting both linear and multiple regressions in preceding sections has failed to identify any existing relationships between or among latent variables (Gil-Garcia, 2008).

Table 9.19: Two limitations of linear regression

Assumes no Measurement Error	• Normally, constructs are measured using a single indicator • This indicator is assumed to perfectly capture the essence of the theoretical construct • Examples of constructs used in social sciences: social status, organizational capability, adequate institutional environment, job satisfaction, policy effectiveness, etc.
Assumes No Indirect Effects	• Does not systematically test relationships among independent variables • Therefore, indirect effects are not represented • Causes are assumed to be independent from each other

Source: adapted from Gil-Garcia (2008)

As Lowry and Gaskin (2014) suggest, the choice of PLS over CB-SEM was based on the fact that this research study is exploratory in nature although the research did not intend to build a new theory, it did however demonstrate that use of multiple theories for exploratory PLS should be selected. For confirmatory work, either technique may be used.

9.7.1 SmartPLS-SEM deployed in this study

The IS discipline examines socioeconomic systems that are characterized by the interplay between hardware and software on the one hand, as well as individuals, groups, and organizations on the other (Urbach and Ahlemann, 2010). For example, technology adoption, acceptance and success, as well as the conditions under which these can be achieved, are typical issues addressed by IS research (Urbach and Ahlemann, 2010). In this research study, we assess the readiness of Komfo Ankye Teaching Hospital to adopt e-Health as the public hospital is in the process of implementing a HIT/e-Health system using a model developed in an earlier study (results presented in another paper). We demonstrate the use of partial least squares –structural equation modeling (PLS-SEM) and argue that this could help to incorporate more realistic assumptions and better measurements into HIT/e-Health adoption readiness assessment research.

PLS was developed in the 1960s and 1970s as a method for predictive modelling (Rönkkö and Evermann, 2013). It is a structural equation modeling (SEM) technique similar to covariance-based SEM as implemented in LISREL, EQS, or AMOS (Chin and Newsted, 1999). It is an alternative to ordinary least square (OLS) regression, canonical correlation, or covariance-based structural equation modeling (SEM) of systems of independent and response variables (Garson, 2016). The partial least squares (PLS) algorithm has become increasingly popular both in IS research and in other disciplines such as marketing (Albers, 2010). Therefore, in this research study, PLS is employed to simultaneously test the measurement model (relationships between indicators and their corresponding constructs) and the structural model (relationships between constructs) (Gil-Garcia, 2008) and also to verify how the data fit the model. While regression results from OLS may be similar to those from PLS (Temme et al., 2006), PLS-SEM models, in contrast, are path models in which some variables may be effected by others whilst still being causes of variable change later in the hypothesized causal sequence (Garson, 2016).

By historical tradition, reflective models (Mode A) have been the norm in structural equation modeling and formative models have been the norm in partial least squares modelling (Garson, 2016). Given, however, that in this study the indicators for measuring the latent variables are highly correlated and interchangeable, they are reflective and their reliability and validity would be comprehensively observed (Hair Jr et al., 2016, Petter et al., 2007), hence the reflective model.

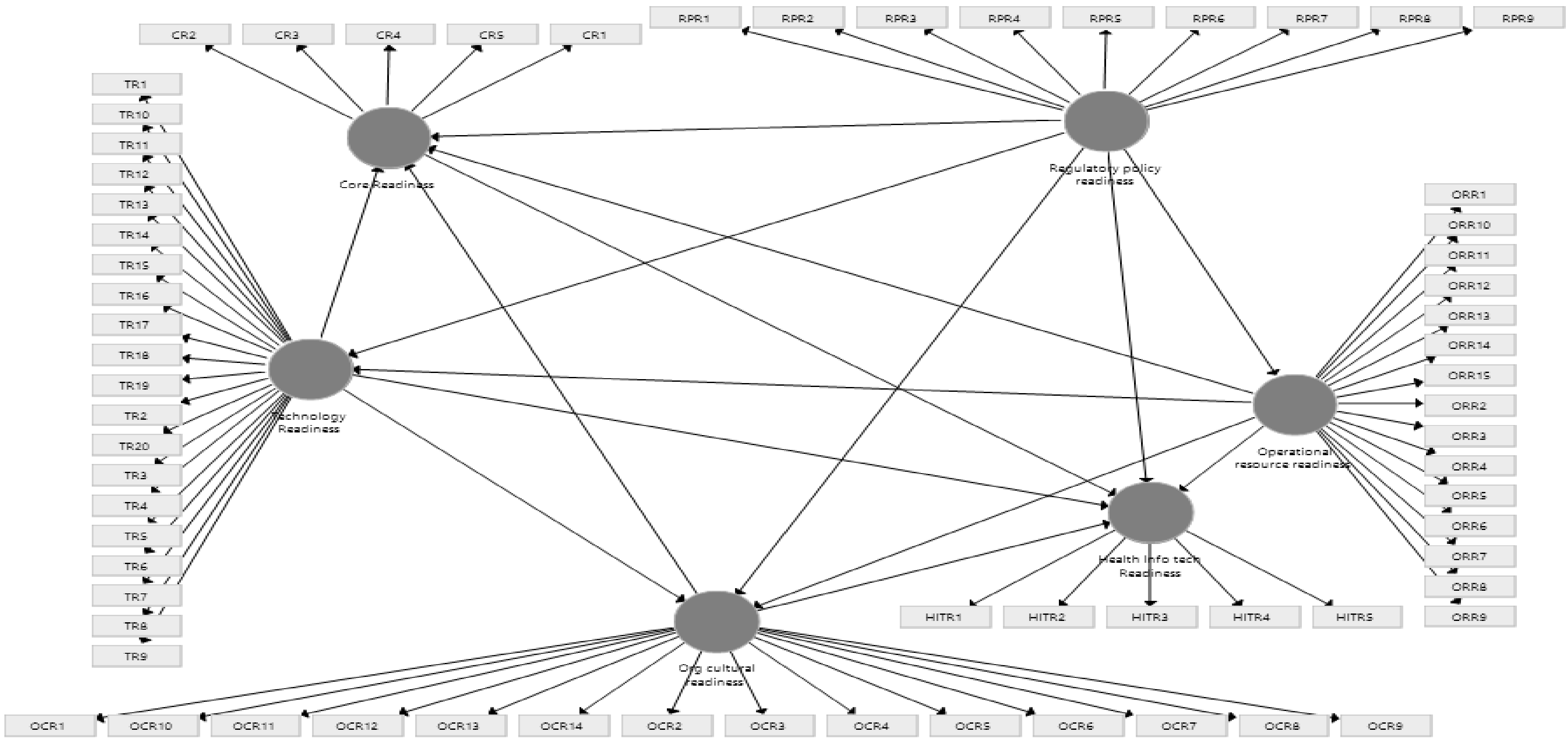
9.7.2 Confirmatory Factor Analysis (CFA)

CFA is a confirmatory technique—it is theory driven. Therefore, the planning of the analysis is driven by the theoretical relationships among the observed and unobserved variables (Schreiber et al., 2006). It is the extension of exploratory factor analysis that can be obtained from SPSS (Afthanorhan, 2013). Assessing overall model fit is an important problem in general structural equation models (Bollen, 1989). Schreiber et al. (2006) thought of structural equation modeling (SEM) as CFA and multiple regression because SEM is more of a confirmatory technique. In this study, in SmartPLS 3 SEM is used in extending the possibility of relationships among the latent variables TR, ORR, OCR, RPR, CR and HITR. Specifically, SEM in this research study encompasses two components: (a) a measurement model (essentially the CFA) and (b) a structural model (Schreiber et al., 2006) in the context of overall *model fit*.

9.8 Theory and hypothesis development

The research model (see Figure 9.4 below) is made up of the Technology-Organizational and Environmental factors (TOE) framework (Tornatzky and Fleischer, 1990) and DeLone & McLean Information Systems Success Model (D&M) IS model (Delone and McLean, 2003) in the context of HIT/e-Health adoption readiness in public healthcare organizations in Ghana. Service quality, Information quality and System quality of DeLone & McLean Information Systems Success Model (D&M) IS model (Delone and McLean, 2003) as confirmed in the initial analysed qualitative data were integrated into the “Technological” component of TOE. Several studies including but not limited to Lin and Lin (2008)); Martins and Oliveira (2009)); Oliveira and Martins (2008)); Oliveira and Martins (2010)); Zhu et al. (2003a)); and Zhu et al. (2006b)) have used TOE framework in determining various electronic-based applications/systems adoption. Previously, Delone and Mclean (2004)) have used a D&M IS model to measure e-Commerce success.

Figure 9.4: SEM Research model



Source: PLS model specification

Technology-Organization-Environment (TOE) framework assumes a generic set of factors to predict the likelihood of IT adoption (Awa et al., 2015). The theory posits that adoption is influenced by technological development, organizational conditions, business and organizational reconfiguration and the industry environment (Awa et al., 2015).

The perspective of TOE has been successfully used to understand key contextual elements that determine IT innovation at the organizational level, and health information systems is no exception (Oliveira and Martins, 2011, Dwivedi et al., 2012). Technology context wise, it has been used to test the IT adoption of web sites for their technology readiness; technology integration and security application (Martins and Oliveira, 2009, Oliveira and Martins, 2008, Zhu et al., 2006b), H1 and H2:

H1: *Technological readiness* will have positive impact on the HIT readiness of KATH.
H2: *Organizational and cultural* readiness will have positive impact on the HIT readiness of KATH.

The environmental context of TOE in this study is attributed to the environment in which healthcare organizations operate, which comprises general economic factors likely to facilitate or inhibit areas of operation. Significant amongst these are partnerships between health care organizations' readiness, socio-cultural issues, funding and health informatics skills set H3, government encouragement in terms of regulatory policies, H4 and technology support infrastructures (Jeyaraj et al., 2006, Scupola, 2009, Zhu et al., 2003b) as well as:

H3: *Operational resource readiness* will have positive impact on the HIT readiness of KATH.
H4: *Regulatory and policy readiness* will have positive effect on the HIT readiness of KATH.

The purpose of strategy formulation is to help organisations to produce effective decisions (doing the right things) shaping the nature and direction of e-health within societal, legal, economic, and technological bounds (Mettler and Vimarlund, 2011). It helps in the identification of a range of clinical and non-clinical services to be accomplished using HIT (H5) and more importantly further helps in questioning the availability of key leadership capacity in implementing formulated strategies, an attribute of the organizational concept of TOE.

H5: *Core readiness* will have positive effect on the HIT readiness of KATH.

9.9 Analysis and results

As (Cain et al., 2016) contend, firstly we calculated the multivariate skewness and kurtosis using software available at Web Power. The result is available here at https://webpower.psychstat.org/models/kurtosis/results.php?url=84d531cdc84c85cc85724748d689b521. The output of the Mardia's multivariate suggested that the data which was collected was not multivariate normal with Mardia's multivariate skewness ($\beta = 4.770$, $p< 0.05$) and Mardia's multivariate kurtosis ($\beta = 55.268$, $p< 0.05$). Consequently, we progressed to use SmartPLS, which is a non-parametric analysis software.

Assessing overall model fit is an important problem in general structural equation models (Bollen, 1989). Schreiber et al. (2006) thought of structural equation modeling (SEM) as CFA and multiple regression because SEM is more of a confirmatory technique.

Given that data was collected from a single site, common method variance (CMV) could be a problem in this study. As a result, and following the suggestions of Podsakoff et al. (2003), various approaches were used during the post-collection statistical analysis in a bid to detect CMV. As Chang et al. (2010) contend, the Harman's single factor test in SPSS was carried out (In SPSS, through "Analyze" – "Dimension reduction" – "Options: Extraction – Fixed Number of factors = 1, Rotation – Method (None). The output showed that only one single factor explained half (50%) of the variance, just meeting the acceptable threshold and escaping the threat that CMV imposes on empirical studies (Chang et al., 2010). In this study, SmartPLS 3 SEM is used in extending the possibility of relationships among the latent variables TR, ORR, OCR, RPR, CR and HITR. Specifically, SEM in this research study encompasses two components: (a) a measurement model (essentially the CFA); and (b) a structural model (Schreiber et al., 2006) in the context of overall *model fit*. According to Hair Jr et al. (2014), the most salient steps for PLS-SEM are:

1) Model specification;
2) Outer model evaluation; and
3) Inner model evaluation.

9.9.1 Model measurement

To assess the measurement model, it was essential to distinguish between reflective and formative measurement models as they require a different evaluation approach (Urbach and Ahlemann, 2010). Once the inner and outer models are specified, the first step in using PLS-SEM involves creating a path model that connects variables and constructs based on theory and logic (Hair Jr et al., 2016). In creating the path model, it was important to distinguish the location of the constructs as well as the relationships between them (Hair Jr et al., 2014). The next step was to run the PLS-SEM algorithm for evaluating the reliability and validity of the construct measures in the outer models based on the Smart PLS 3 output/results.

9.9.1.1 Criteria for assessing the outer model

By starting with the assessment of the outer models, the researcher can trust that the constructs, which form the basis for the assessment of the inner model relationships, are accurately measured and represented (Hair Jr et al., 2014). The first stage, the outer model is often used to assess the reliability and construct validity of measurement items. As Lee and Che (2013) suggest, four common criteria were used in assessing the outer model as follows:

9.9.1.1.1 Unidimensionality

According to Urbach and Ahlemann (2010) unidimensionality cannot be directly measured with PLS, but can be assessed using an exploratory factor analysis (EFA). As such, in this research study, the EFA's objective was to establish the convergence measurement items to the corresponding constructs and each item loading with a high coefficient on one factor alone, and the factor being the same for all items that are supposed to measure it (Urbach and Ahlemann, 2010). An output from the PLS Algorithm showed items with loading coefficient ranging from 0.790 to 0.884 for CR; 0.724 to 0.904 for HITR; 0.791 to 0.872 for OCR; 0.729 to 0.872 for ORR; 0.804 to 0.890 for RPR; and 0.794 to 0.889 for TR respectively.

9.9.1.1.2 Reliability

Reliability is mainly used to assess the internal consistency in a construct. Aspects of PLS that are used to assess reliability in reflective models include: Cronbach's alpha; Composite reliability; and Average variance extracted (AVE) (Garson, 2016). In this study, composite reliability for all constructs was high and ranged from 0.928 to 0.990 (TR=0.990; ORR=0.970; OCR=0.970; RPR=0.962; CR=0.928 and HITR=0.934), while Cronbach's Alpha ranged from

0.910 to 0.979; and average variance extracted (AVE) values ranging from 0.680 to 0.740 (see Table 9.21 below).

Table 9.20: Construct reliability and validity

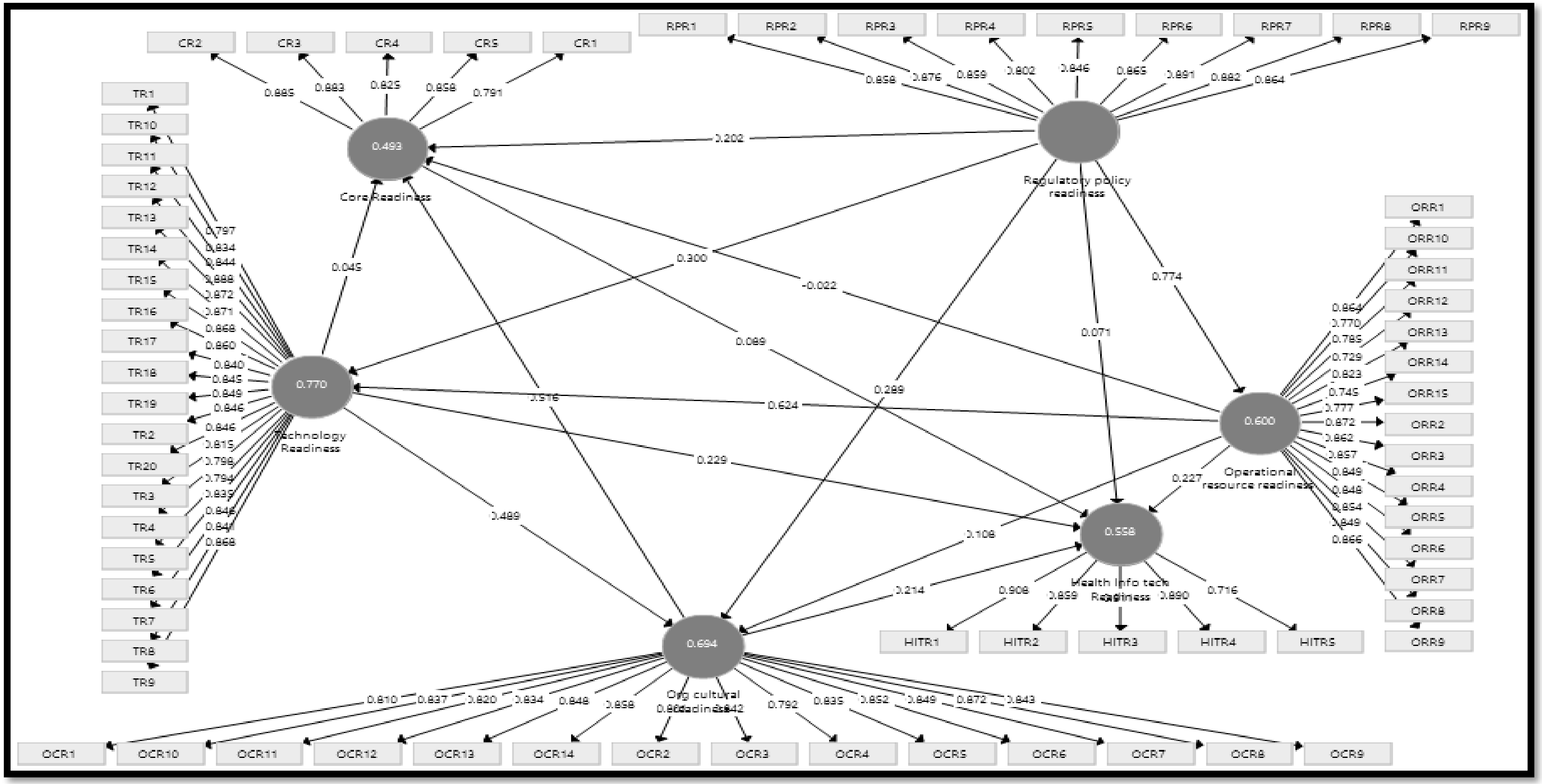
Constructs	Items	Loadings[a]	Cronbach α[b]	AVE[c]	CR[d]
CR: Core readiness	CR1	**0.793**	**0.903**	**0.721**	**0.928**
	CR2	**0.888**			
	CR3	**0.884**			
	CR4	**0.824**			
	CR5	**0.853**			
HITR: Health information tech. readiness	HITR1	**0.715**	**0.910**	**0.739**	**0.934**
	HITR2	**0.911**			
	HITR3	**0.859**			
	HITR4	**0.890**			
	HITR5	**0.908**			
OCR: Organizational cultural readiness	OCR1	**0.843**	**0.967**	**0.698**	**0.970**
	OCR2	**0.837**			
	OCR3	**0.819**			
	OCR4	**0.835**			
	OCR5	**0.846**			
	OCR6	**0.855**			
	OCR7	**0.809**			
	OCR8	**0.797**			
	OCR9	**0.842**			
	OCR10	**0.796**			
	OCR11	**0.839**			
	OCR12	**0.854**			
	OCR13	**0.850**			
	OCR14	**0.870**			
ORR: Operational resource readiness	ORR1	**0.860**	**0.966**	**0.680**	**0.970**
	ORR2	**0.867**			
	ORR3	**0.856**			
	ORR4	**0.853**			
	ORR5	**0.842**			
	ORR6	**0.845**			
	ORR7	**0.851**			
	ORR8	**0.847**			
	ORR9	**0.864**			
	ORR10	**0.776**			
	ORR11	**0.792**			
	ORR12	**0.737**			
	ORR13	**0.89**			
	ORR14	**0.753**			

	ORR15	**0.783**			
RPR: Regulatory policy readiness	RPR1	**0.861**	**0.956**	**0.740**	**0.962**
	RPR2	**0.878**			
	RPR3	**0.862**			
	RPR4	**0.865**			
	RPR5	**0.891**			
	RPR6	**0.881**			
	RPR7	**0.862**			
	RPR8	**0.798**			
	RPR9	**0.844**			
TR: Technology readiness	TR1	**0.794**	**0.979**	**0.711**	**0.980**
	TR2	**0.845**			
	TR3	**0.813**			
	TR4	**0.798**			
	TR5	**0.793**			
	TR6	**0.846**			
	TR7	**0.851**			
	TR8	**0.847**			
	TR9	**0.834**			
	TR10	**0.846**			
	TR11	**0.842**			
	TR12	**0.869**			
	TR13	**0.835**			
	TR14	**0.845**			
	TR15	**0.888**			
	TR16	**0.872**			
	TR17	**0.870**			
	TR18	**0.868**			
	TR19	**0.860**			
	TR20	**0.840**			

Source: PLS3 Algorithm Output

a. All item loadings > 0.4 indicates Indicator reliability Hulland (1999)
b. All Cronbach's Alpha > indicates Indicator Reliability Nunnally (1978)
c. All Average Variance Extracted (AVE) > 0.5 indicates Convergent Reliability Bagozzi and Yi (1988), Fornell and Larcker (1981)
d. All Composite reliability (CR) > 0.7 indicates Internal Consistency Gefen et al. (2000)

Figure 9.5: PLS Algorithm Output showing outer loadings for reflective LVs and formative LVs



Source: PLS Algorithm procedure output

9.9.1.1.3 Convergent validity

Fornell and Larcker (1981), Hair Jr et al. (2010) cited in Lee and Che (2013) posited that convergent validity, which is often used to measure the correlation of a dimension's multiple indicators, is acceptable if the following criteria are met: (i) the statistical significance of each factor loading is confirmed by a p-value of 0.05; (ii) construct reliability exceeds 0.7; and (iii) average variance extracted (AVE) is greater than 0.5. In this study, all three conditions were met as i) p-values for all factors were 0.00 ($p > 0.05$); ii) construct reliability exceeded 0.7 for all constructs; and iii) AVE ranged from 0.680 to 0.740.

9.9.1.1.4 Discriminant validity

Convergent validity involves the degree to which individual items reflect a construct converge in comparison to items measuring different constructs (Urbach and Ahlemann, 2010). Convergent validity is often assessed by a construct and its indicators being distinct from another (having its own set of construct and its indicators) in the outer model. Outer/indicator loadings for all constructs ranged from 0.715 to 0.911 (see Table 9.21 above), which indicate a high validity/reliability. Because reflective indicators are linked to a construct through loadings, which are the bivariate correlations between the indicator and the construct, reliability and validity were first verified and this was done using composite validity in evaluating the constructs' internal consistency reliability. Discriminant validity values ranged from 0.544 to 0.861. Validity is examined by noting a construct's convergent validity and discriminant validity (Hair Jr et al., 2014). Support is provided for convergent validity when each item has outer/indicator loadings above 0.70 (Hair Jr et al., 2014, Garson, 2016) and when each construct's AVE is 0.50 or higher (Hair Jr et al., 2014). Discriminant validity was assessed by comparing the square root of AVE for each construct to the correlation of that construct with other constructs. The AVE is the grand mean value of the squared loadings of a set of indicators (Hair Jr et al., 2016) and is equivalent to the communality of a construct. Discriminant validity in this study was also assessed using the Fornell and Larker Criterion as well as the heterotrait-monotrait ratio of correlations (HTMT) ratio.

According to the Fornell-Larcker testing system, discriminant validity can be assessed by comparing the amount of variance captured by the construct and the shared variance with other constructs (Alarcón and Sánchez, 2015). As can be seen in Table 9.22 below, the levels of square root of the AVE for each construct is be greater than the correlation involving the constructs.

Table 9.21: Assessment of discriminant validity using the Fornell-Larcker Criterion

	CR	HITR	OCR	ORR	RPR	TR
CR: Core Readiness	0.849					
HITR: Health Information Technology Readiness	0.544	0.860				
OCR: Organizational Cultural Readiness	0.686	0.685	0.835			
ORR: Operational Resource Readiness	0.559	0.690	0.747	0.825		
RPR: Regulatory Policy Readiness	0.608	0.643	0.753	0.771	0.860	
TR: Technology Readiness	0.599	0.706	0.805	0.856	0.783	0.843

Note: ***Square roots of average variances extracted (AVEs) shown on diagonal, which is the square root of the variance shared between the constructs and their measure.***

Henseler et al. (2015) proposed the heterotrait-monotrait ratio of correlations (HTMT) as a new approach to assess discriminant validity in variance-based SEM. "The HTMT ratio is the geometric mean of the heterotrait-heteromethod correlations (i.e., the correlations of indicators across constructs measuring different phenomena) divided by the average of the monotrait-heteromethod correlations (i.e., the correlations of indicators within the same construct)" (Garson, 2016). As a solution for this critical issue, although examination of cross-loadings and use of the Fornell-Larcker Criterion are accepted methods for assessing the discriminant validity of a PLS model, these methods have shortcomings (Garson, 2016). See Table 9.23 below summary of HTMT ratio.

Table 9.22: Summary values for Heterotrait-Monotrait Ratio (HTMT Ratio)

	CR	HITR	OCR	ORR	RPR	TR
CR: Core Readiness						
HITR: Health Information Technology Readiness	0.621					
OCR: Organizational Cultural Readiness	0.736	0.728				
ORR: Operational Resource Readiness	0.598	0.730	0.773			
RPR: Regulatory Policy Readiness	0.657	0.688	0.784	0.800		
TR: Technology Readiness	0.638	0.742	0.829	0.879	0.809	

Source: PLS3 bootstrap output

As Garson (2016) posited, in a well-fitting model, heterotrait correlations should be smaller than monotrait correlations, implying that the HTMT ratio should be below 1.0. Henseler et al. (2015), however, suggested 0.9 as cutoff and an even stricter cutoff of 0.85 was used by Kline (2015). Consequently, as can be seen in Table 9.24 above, a discriminant validity was established between a given pair of reflective constructs in this study given that HTMT values for all pairs of reflective constructs ranged from 0.598 to 0.879 (below 1.0). HTMT values smaller than 1.0 show that the true correlation between the two constructs should differ (Alarcón and Sánchez, 2015).

Table 9.23 Summary values for Heterotrait-Monotrait Ratio (HTMT)

Path	Path Coefficient	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
CR -> HITR_	0.089	0.087	0.072	1.229	0.219
OCR -> CR	0.516	0.510	0.107	4.833	0.000
OCR -> HITR_	0.214	0.208	0.073	2.949	0.003
ORR -> CR	-0.022	-0.023	0.121	0.179	0.858
ORR -> HITR_	0.227	0.232	0.055	4.113	0.000
ORR -> OCR	0.108	0.109	0.073	1.469	0.143
ORR -> TR_	0.624	0.623	0.054	11.667	0.000
RPR -> CR	0.202	0.207	0.081	2.502	0.013
RPR -> HITR_	0.071	0.068	0.050	1.422	0.156
RPR -> OCR	0.289	0.293	0.066	4.373	0.000
RPR -> ORR	0.774	0.773	0.032	23.891	0.000
RPR -> TR_	0.300	0.300	0.054	5.601	0.000
TR_ -> CR	0.045	0.048	0.131	0.340	0.734
TR_ -> HITR_	0.229	0.235	0.075	3.070	0.002
TR_ -> OCR	0.489	0.484	0.081	6.019	0.000

Source: PLS3 Output exported to Excel

9.9.2 Criteria for assessing the Inner Model

In this research the inner model was the functions of the structural model in CBSEM, which are often used to assess the Goodness-of-fit and research hypotheses in the proposed research framework (Lee and Che, 2013). Urbach and Ahlemann (2010) suggest that, there are five common criteria to assess the outer model as follows:

9.9.2.1 Coefficient of determination (R-Square, R^2)

The coefficient is an index to measure each endogenous latent variable's R-Square (Lee and Che, 2013). Five out of the six constructs/latent variables had R2 with explanatory powers ranging from substantial to values above moderate, if the suggestions of Chin (1998)) are anything to go by. HITR: R2 = 0.558; OCR: R2 = 0.694; ORR: R2 = 0.314; CR: R2 = 0.493; and TR: R2 = 0.770; and RPR (exogenous variable).

Table 9.24: Summary of R Square and R-Square Adjusted Constructs/Latent Variables

Constructs	R- Square	R-Square Adjusted
CR	0.493	0.486
HITR_	0.558	0.551
OCR	0.694	0.691
ORR	0.600	0.598
TR_	0.770	0.768

Source: SmartPLS 3 Output exported to excel

9.9.2.2 Goodness-of-fit (GoF)

Goodness-of-fit (GoF) is an index for the outer and inner model to confirm that the model adequately explains the empirical data. The overall GoF of the model was the starting point of this model assessment (Henseler et al., 2016). PLS path modeling's tests of model fit rely on the bootstrap to determine the likelihood of obtaining a discrepancy between the empirical and the model-implied correlation matrix that is as high as the one obtained for the sample at hand if the hypothesized model is indeed correct (Dijkstra and Henseler, 2015, Sanchez, 2013). Although values of the Chronbach's Alpha, Composite reliability and AVE suggest statistical significance, (Helm et al., 2009) recommended that a standard error must be obtained using bootstrapping to test for significance in this research study in order to avoid relying on relationships that, although significant, may be too small to merit any credible conclusion.

In this study, the standardized root mean square residual (SRMR) reflects the average magnitude of such differences. It is a measure of approximate fit for the researcher's model and measures the difference between the observed correlation matrix and the model-implied correlation matrix (Garson, 2016). Conventionally, a model has a good fit when SRMR is less than .08 (Hu and Bentler, 1999, Sanchez, 2013). Some researchers use the more lenient cut-off of less than .10 (Garson, 2016). The SRMR was introduced by Henseler et al. (2016) as a GoF measure for PLS-SEM in order to preclude model misspecification. Furthermore, the normed fit index (NFI) was also assessed. The NFI, which is also known as the Bentler-Bonett normed fit index (Moss, 2009) is an incremental fit measure which computes the Chi-square value of the proposed model and relates it to a meaningful standard (Bentler and Bonett, 1980). The NFI value for this model is 0.739, which implies that this model improves the fit by 73.9%

relative to the null or independence model. A model fits well if the difference between the correlation matrix implied by your model and the empirical correlation matrix should be non-significant (p > 0.05) (Ramayah et al., 2017). In this regard (Henseler et al., 2016) contend that d_ULS and d_G < less than the 95% in the context of bootstrapped quantile (HI 95% of d_G).

Given that the saturated model (measurement) fit values and the estimated model (structural model) fit values were exactly the same makes the model a saturated one with zero free paths. SRMR=0.054 (> 0.08); NFI=0.739, less than the suggested acceptance value of 0.9,(Byrne, 1994) or 0.95 (Lomax and Schumacker, 2012). While the acceptable NFI in literature is known be 0.9 or higher the fit index varies from 0 to 1 where 1 is ideal (Moss, 2009). Rules of thumb for this measure, however, recommend that models with a NFI less than 0.9 can usually be substantially improved (Bentler and Bonett, 1980). The d_ULS < bootstrapped HI 95% of d_ULS and d_G < bootstrapped HI 95% of d_G indicating the data still fits the model well.

Table 9.25: Summary of Model Fit

	Saturated Model	Estimated Model
SRMR	0.054	0.054
d_ULS	6.717	6.717
d_G	6.231	6.231
Chi-Square	6,795.276	6,795.276
NFI	0.739	0.739

Source: PLS3 Output exported to Excel

9.9.2.3 Path coefficient

Observing the direction and significance of path coefficient may help a researcher to understand the research hypotheses, whether or not supported in the proposed model. A path coefficient’s magnitude indicates the strength of the relationship between two latent variables (LVs) (Urbach and Ahlemann, 2010). In this research study, the bootstrap test procedure in SmartPLS was used to establish whether regression weights were actually significant. The standard decision dictates that a *t*-value of greater than 1.96 is significant at confidence level 95%, equivalent of $P < 0.05$. All paths coefficient appear to be significant with the strongest being between regulatory and policy readiness and operational resource readiness (RPR ->

ORR) with T-statistics of 23.891. Similarly, operational resource readiness on technology readiness (ORR -> TR) was significant with T-statistics of 11.667.

Table 9.26: Summary of significant result testing of the structural model path coefficient

Path	Path Coefficient	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
CR -> HITR_	0.089	0.087	0.072	1.229	0.219
OCR -> CR	0.516	0.510	0.107	4.833	0.000
OCR -> HITR_	0.214	0.208	0.073	2.949	0.003
ORR -> CR	-0.022	-0.023	0.121	0.179	0.858
ORR -> HITR_	0.227	0.232	0.055	4.113	0.000
ORR -> OCR	0.108	0.109	0.073	1.469	0.143
ORR -> TR_	0.624	0.623	0.054	11.667	0.000
RPR -> CR	0.202	0.207	0.081	2.502	0.013
RPR -> HITR_	0.071	0.068	0.050	1.422	0.156
RPR -> OCR	0.289	0.293	0.066	4.373	0.000
RPR -> ORR	0.774	0.773	0.032	23.891	0.000
RPR -> TR_	0.300	0.300	0.054	5.601	0.000
TR_ -> CR	0.045	0.048	0.131	0.340	0.734
TR_ -> HITR_	0.229	0.235	0.075	3.070	0.002
TR_ -> OCR	0.489	0.484	0.081	6.019	0.000

9.9.2.4 Evaluation of model effect size (f^2)

The next step after bootstrapping in assessing the structural model in this research was the evaluation of the model effect size *(f^2)* of each path in the structural equation model by means of Cohen's f^2 (Cohen, 1988), (see table 9.28). The f^2 measures if an independent LV has a substantial impact on a dependent LV (Urbach and Ahlemann, 2010).

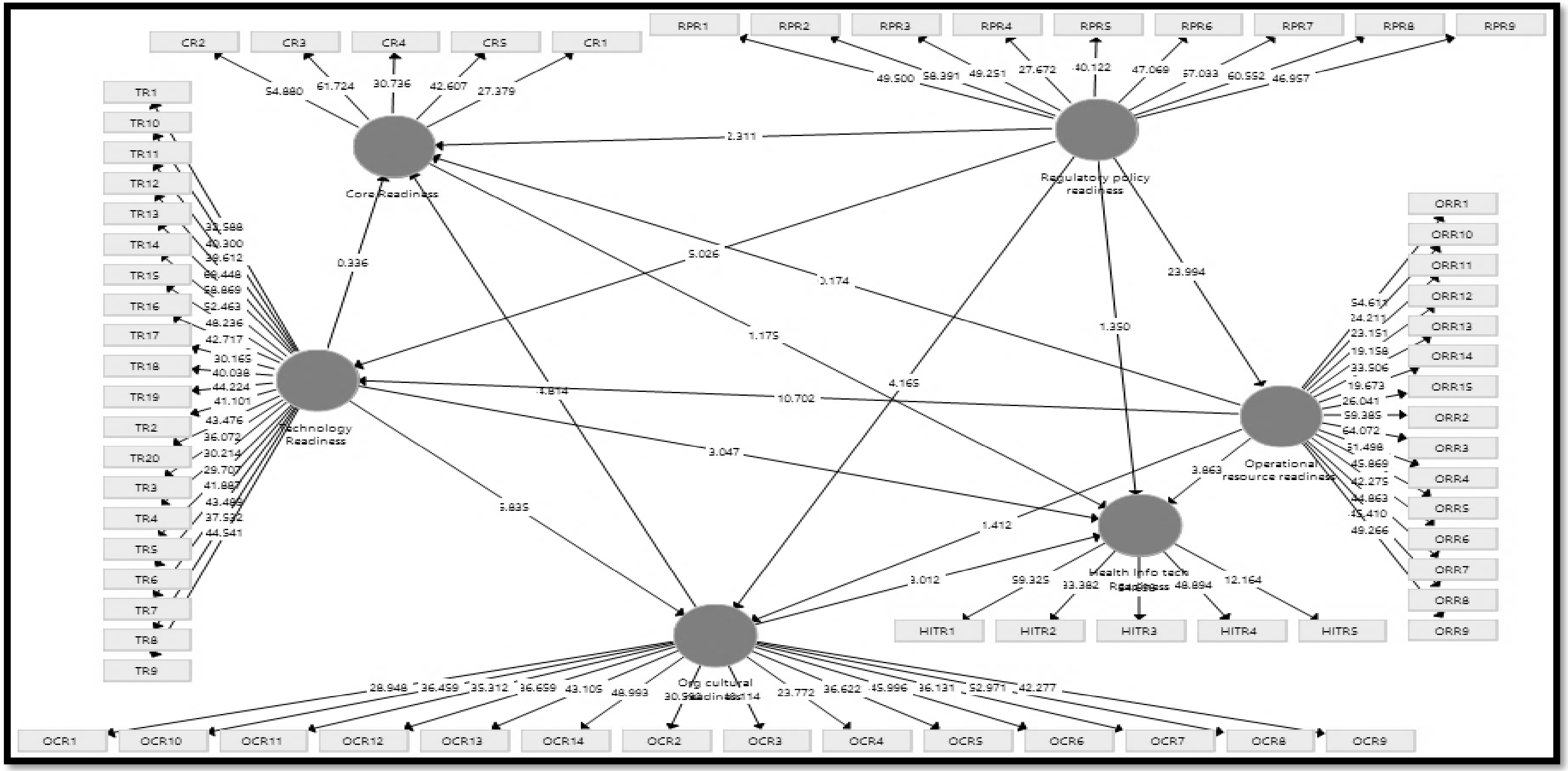
Table 9.27: Summary of values of model effect size (f^2)

	CR	*HITR_*	*OCR*	*ORR*	*RPR*	*TR_*
CR		0.009				
*HITR_*						
OCR	0.161	0.027				
ORR	0.000	0.027	0.009			0.679
RPR	0.026	0.004	0.094	1.497		0.157
*TR_*	0.001	0.023	0.180			

Source: PLS 3 output

The f^2 of the exogenous variables with reference to Table 9.28 above indicate that OCR (f^2 = 0.027); ORR (f^2 = 0.028); and TR (f^2 = 0.023) had little impact on HITR at KATH. As per the threshold recommended by (Chin, 1998, Cohen, 1988), values for f^2 between .020 and .150, between .150 and .350, and exceeding .350 indicate that an exogenous LV has a small, medium, or large effect on an endogenous LV. Consequently, f^2 values less of than 0.020 (as was the case with CR and RPR (f^2 values of 0.009 and 0.004) respectively) suggests that the two independent variables did not have any impact on the dependent variable HITR in the case of KATH. The failing f^2 values of 0.004 was unsurprising given that participants indicate in earlier interviews that a number of public healthcare facilities were going paperless despite the absence of any reliable HIT/e-Health regulatory at the national level to guide the adoption and use of various HIT/e-Health systems.

Figure 9.6: PLS 3 Output showing t-statistics from bootstrapping procedure

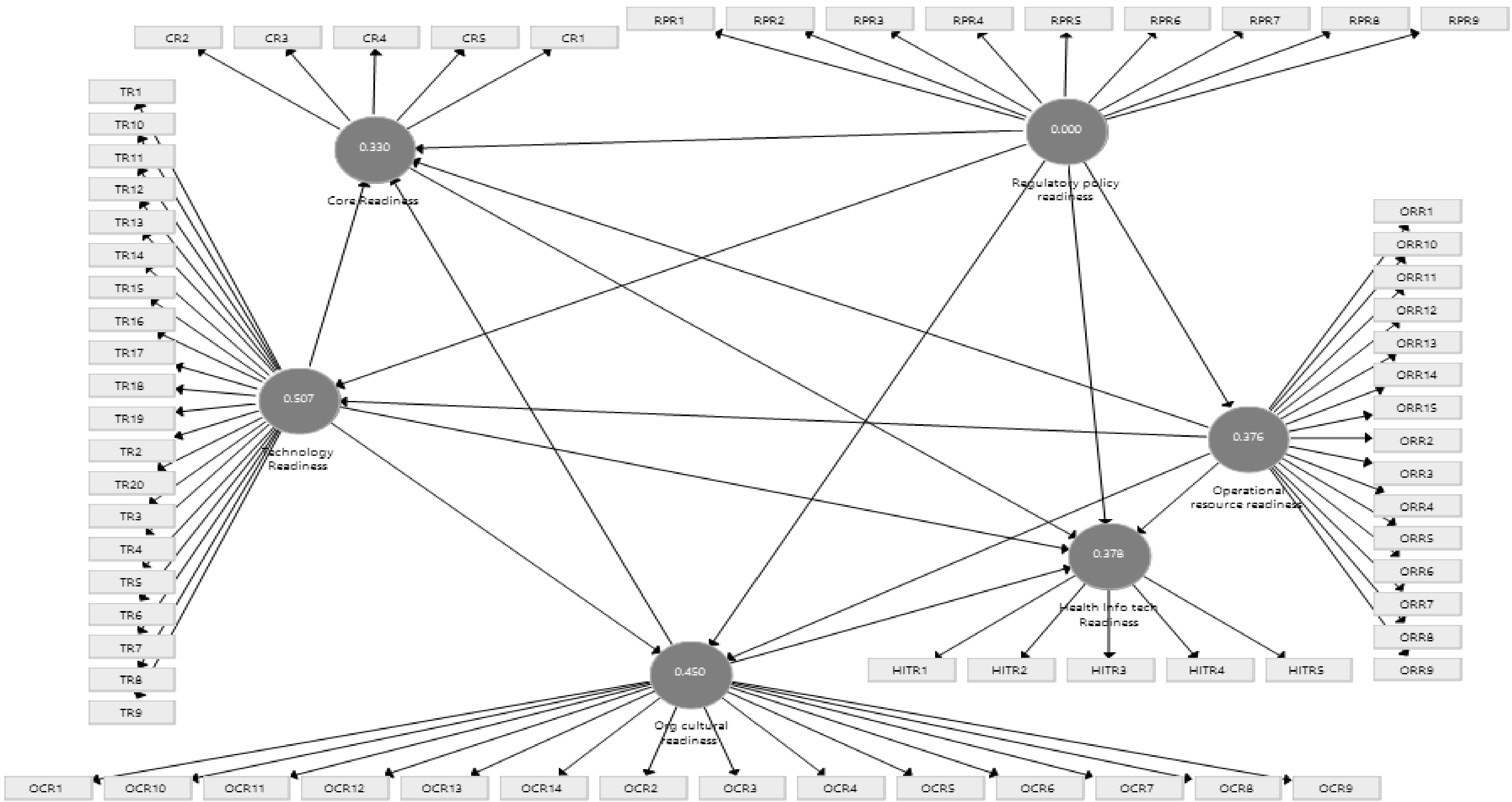


Source: PLS 3 output

9.9.2.5 Predictive relevance (Q^2)

Another test applied to this version of SmartPLS 3 model was the Stone-Geisser test of predictive relevance. The Q^2 statistic (Stone, 1974, Geisser, 1975) is a measure of the predictive relevance of a block of manifest variables (Urbach and Ahlemann, 2010). To assess the predictive relevance of the model being validated in this study, the Stone-Geisser Q^2 was obtained through the underlying latent variable score case from which the cross-validated (cv) communality is obtained using the blindfolding procedure. The cv-communality measures the capacity of the path model to predict the manifest variables or data points from their own latent variable score, and serves as an indicator of the quality of the measurement model (Vinzi et al., 2010). The smaller the difference between predicted and original values the greater the Q^2 and thus the model's predictive accuracy. In other words, if the Q^2 value is larger than zero for a particular endogenous construct this indicates the path model's predictive relevance for that particular construct (Hair Jr et al., 2014). The model's $\boldsymbol{R^2}$ of **0.558** establishes that the model explains 55.8% of the total amount of variance in health information technology/e-Health readiness at KATH (Chin, 1998, Vinzi et al., 2010), which is good. More so, the model's predictive relevance (Q^2) is assessed with a nonparametric Stone-Geisser test. Predictive relevance for the overall model is confirmed as the $Q^2 > 0$ $Q^2_{\text{Health information technology readiness (HITR)}} = 0.378$. The Q^2 values of both the full model and adjusted model (without RPR) did not change and without CR ($Q^2_{\text{Health information technology readiness (HITR)}} = 0.377$). A difference of 0.001 is an indication of the predictive accuracy of the model. The smaller the difference between predicted and original values the greater the Q^2 and thus the model's predictive accuracy (Hair Jr et al., 2014). Similarly, all endogenous constructs are confirmed as $Q^2 > 0$ $Q^2_{\text{Core Readiness (CR)}} = 0.330$; $Q^2_{\text{Organizational cultural Readiness (OCR)}} = 0.450$; $Q^2_{\text{Operational resource Readiness (ORR)}} = 0.376$; and $Q^2_{\text{Technological Readiness}} = 0.577$.

Figure 9.7: PLS 3 output from blindfolding procedure showing Q² values



9.10 Findings

The final model partially supports the hypothesis of this study. Table 9.29 presents a summary of the results of the PLS-SEM analysis. Given that PLS-SEM estimates the measurement model and the relationships between constructs simultaneously, the significance of weights of the constructs display the significance of their impact on HIT/e-Health readiness. These weights can be interpreted similarly to the beta coefficients from a multiple regression analysis.

According to the model assessment outcomes, support is found for the following hypotheses:

- **Hypothesis 1:** *Technological readiness* will have a direct/positive impact on the readiness of KATH to successfully adopt HIT (β =.229, f^2=.023, t = 3.070)
- **Hypothesis 2:** *Organizational and cultural readiness* will have a significant impact on the readiness of KATH to successfully adopt HIT (β =.214, f^2=.027, t = 2.949
- **Hypothesis 3:** *Operational resource readiness* will have a direct/positive impact on the readiness of KATH to adopt HIT (β =.227, f^2=.027, t = 4.113

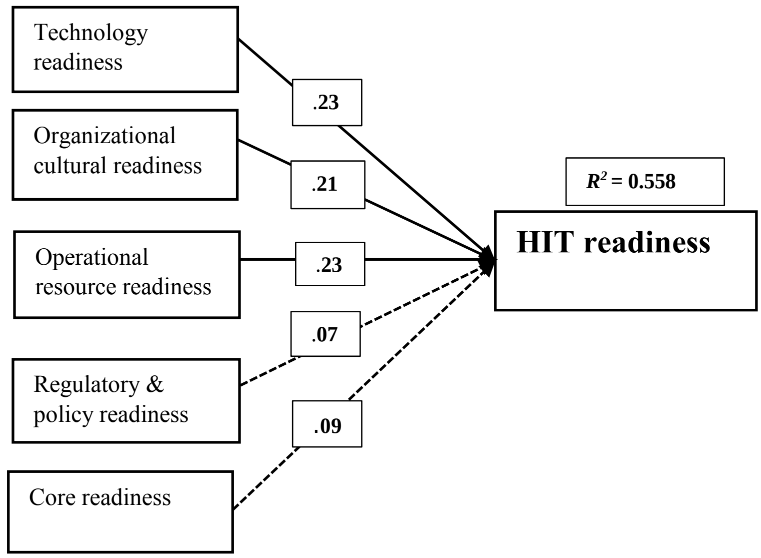
Table 9.28: Structural model hypothesis testing for direct effects

Hypothesis	Relationship	Std β	Std Error	t-Value*	Decision	F^2	Q^2	5%CI LL	95%CI UP
H1	Technology readiness -> Health Information Technology Readiness	0.229	0.075	3.070	Supported*	0.023	0.507	0.003	0.069
H2	Organizational Cultural Readiness -> Health Information Technology Readiness	0.214	0.073	2.949	Supported*	0.027	0.450	0.002	0.082
H3	Operational Resource Readiness -> Health Information Technology Readiness	0.227	0.055	4.113	Supported*	0.027	0.376	0.007	0.072
H4	Regulatory Policy Readiness Health Information Technology Readiness	0.071	0.050	1.422	Not Supported	0.004	0.000	0.000	0.021
H5	Core Readiness -> Health Information Technology Readiness	0.089	0.072	1.229	Not Supported	0.009	0.330	0.000	0.066

Significance Key: * for p<.05 and ** for p<.01

Source: Smart

Figure 9.28: Final structural model assessed



Source: Developed for this study

9.10.1 Indirect Relations among Unobserved (Independent) Variables

Although no formal hypotheses were proposed for the relationships/effects which exist between exogenous/independent constructs in the model structure, the SmartPLS 3 model path analysis did show that such relationships exist as summarised in Table 9.30 below. The T-statistics and *beta* values in Table 9.30 demonstrate, for instance, the notable impact that regulatory and policy readiness (RPR) have on organizational resource readiness (ORR) given that t = 23.891, *beta* = 0.774 obtained from the bootstrap procedure and a. A related significant association was exhibited between operational resource readiness (ORR) and technological readiness (TR) (t = 11.667, *beta* = 0.624). Below is the Table, 9.30 also summarizes the indirect relationship among unobserved variables.

Table 9.29: Structural Model Hypothesis testing for mediation (indirect effects)

Hypothesis	Relationship	Std Beta	Std Error	t-value	Decision	5%CI LL	95%CI UP
H6	Organizational Cultural readiness -> Core Readiness	0.516	0.107	4.833	Supported*	0.294	0.711
H7	Operational Resource Readiness -> Core Readiness	-0.022	0.121	0.179	Not Supported	-0.233	0.208
H8	Operational Resource Readiness -> Organizational Cultural readiness	0.108	0.073	1.469	Not Supported	-0.021	0.250
H9	Operational Resource Readiness -> Technology Readiness	0.624	0.054	11.667	Supported*	0.515	0.717
H10	Regulatory Policy Readiness -> Core Readiness	0.202	0.081	2.502	Supported*	0.053	0.366
H11	Regulatory Policy Readiness -> Organizational Cultural readiness	0.289	0.066	4.373	Supported*	0.159	0.414
H12	Regulatory Policy Readiness -> Operational Resource Readiness	0.774	0.032	23.891	Supported*	0.706	0.829
H13	Regulatory Policy Readiness -> Technology Readiness	0.300	0.054	5.601	Supported*	0.204	0.410
H14	Technology Readiness -> Core Readiness	0.045	0.131	0.340	Not Supported	-0.231	0.298
H15	Technology Readiness -> Organizational Cultural readiness	0.489	0.081	6.019	Supported*	0.329	0.635

*Significance Key: * for p<.05 and ** for p<.01*

Source: PLS 3 output

9.11 PLS-SEM Discussion

This advanced analysis which occurs after the exploratory factor analysis (EFA) is an approach to confirm the relationship between the dependent variable Health information technology readiness (HITR) and the independent variables: Technology readiness (TR); Operational resource readiness (ORR); Organizational cultural readiness (OCR); Regulatory and policy readiness (RPR); and Core readiness (CR), through SEM confirmatory factor analysis (EFA) using SmartPLS 3.

Two important aspects of the research model developed in previous chapters were important in the SEM analysis in PLS: (1) measurement fit for the reflective models, which concerns the fit of the outer model; and (2) structural fit, which deals with the fit of the structural (inner) model.

In assessing the outer model, four characteristics of the outer model were analysed Unidimensionality; reliability; convergent validity; and discriminant validity. Firstly, unidimensionality, which established that all measurement items were actually measuring their corresponding constructs as they converged with high coefficients above 0.70 and AVE above

0.6. Support was provided for convergent validity when each item had outer loadings above 0.70 and construct's AVEs were above 0.50, where the AVE was assumed to be equivalent to the communality of a construct (Hair Jr et al., 2016). The discriminant validity of the outer model was assessed using the outer loadings for all reflective variables (indicators) and actual discriminant validity coefficients (0.544-0.860).

In addition, the HTMT proposed by Henseler et al. (2015) as a new method of assessing discriminant validity was also taken into account. The HTMT values for all model paths were below 1.0 (ranging from 0.621 to 0.879), which indicate that the model was well-fitting (Garson, 2016).

In stage 2, the model's GoF and the research hypotheses were assessed through coefficient determination (R-Square, R^2), the standardized root mean square residual (SRMR), the path coefficient, the model effect size *(f^2)*, and the predictive relevance (Q^2) of the model. While the outcomes of the majority of tests/analyses in this advanced stage confirmed the early findings, the outcome of the final model suggests support for three (H1, H2 and H3) of the five hypotheses. In other words, the final model did not support H4 and H5 as opposed to the initial outcome of the multiple regression procedure conducted in SPSS earlier on.

The path ORR to HITR (t = 4.053) were the strongest among the five, suggesting that for HIT to thrive there was the need for continuous flow of sufficient operational resources in the context of funding and health informatics trained workforce. On the contrary, continuous shortage of operational resources are known predicaments of HIT/e-Health in developing countries (Barrington et al., 2010, Geissbuhler et al., 2007, Khan et al., 2010, Nabiev et al., 2010).

HIT/e-Health is the use of ICT in healthcare. Therefore, the availability of ICT infrastructure is a core requirement for HIT/e-Health and that has played out in this study given TR/HITR (t = 3.091), being the second among the five hypotheses. Several researches including Yusif and Soar (2014), Gregory and Tembo (2017), Adebesin et al. (2013) who all focus on the adoption of ICT in the healthcare environment, have identified a lack of ICT infrastructure as one of the leading setbacks in the bid to institutionalize ICT use in healthcare.

Organizational culture (t = 2.885) equally plays an important role in ICT adoption in the healthcare environment (Zakaria et al., 2009). Organizations with cultures that value learning and seek to encourage both individual and organizational learning are often characterized as being more organic (Bangert and Doktor, 2003). In the healthcare environment, healthcare providers have entertained fears towards adopting health information technologies as part and parcel of practices to improve healthcare delivery. Among the factors identified by Barzekar and Karami (2014) to be impacting upon the successful implementation of information technology in health systems was organizational culture featured heavily. Social influences include: subjective norm; competition; a supportive organizational culture for change, and friendship network (Li et al., 2013b). The degree of a health care provider's perception of organizational culture (e.g., learning culture) helps us understand how supportive individual will be to eHealth adoption (Dansky et al., 1999). The culture of the organization, including its supportive elements, influences both the implementation and persistence of the work innovation (Dansky et al., 1999).

Remarkably, there was no significant relationship between core readiness and HITR. Through interviews with IT managers within participating healthcare organizations, the need for some form of strategic plan was apparent. While most of the respondents appeared to suggest the inevitability of HIT strategic plans, perhaps there was a lack of true utilization of such plans. Unlike the striking insignificant association between CR and HITR ($t = 1.107$), all the evidence points to the absence of any reliable health information technology policy document against many healthcare facilities going paperless, RPR to HITR ($t = 1.322$) in the SEM being confirmation of the former findings.

9.12 Limitations

In this research two different aspects of the model were assessed: outer (reflective) and inner (formative) of the model in two discrete phases using two different procedures-CFA for the outer and PLS-SEM for the inner. According to MacCallum et al. (1992), in the applications of covariance structure modeling and the practice of modifying data-driven models to improve their fit, the models are essentially predisposed to capitalization on chance. As such the multiple regression procedure conducted in this study may have capitalized on chance by assigning greatest weight to those variables which happen to have the strongest relationships with the criterion variable (Berger, 2003).

9.11 Conclusion

In this chapter, a structural model was developed to an advanced level and tested for health information technology/e-Health adoption readiness at KATH. The PLS-SEM was used to explore the associations between and among factors identified in the preliminary model. The outcome of the analyses of all three models were different. In the first model, at the EFA, Value proposition readiness was not supported. In the second model, the remaining five independent constructs were all supported as all five hypotheses were accepted. In this advanced and final stage analysis, the final structural model supported three out of the five hypotheses.

Chapter 10 will provide discussions of both the qualitative and the quantitative findings of this research study.

CHAPTER 10 DISCUSSION

Chapter overview

In the preceding chapters, various discussions took place on the processes/strategies associated with collecting data (qualitative and quantitative) and their analyses. In this chapter, the implications of the findings are presented for the wider Information Systems (IS)/Information Technology (IT) research communities and the discussion arising from the testing of the hypotheses is presented.

10.0 Introduction

This research began with a review of existing literature and identified gaps from which the following research questions were formulated:

> **Research Question 1:** What factors are perceived to promote HIT readiness in public hospitals in Ghana?
>
> **Research Question 2:** What are the barriers to HIT readiness in public hospitals in Ghana?
>
> **Research Question 3:** What relationships exist among these factors?

Five constructs eventually represented factors perceived to be promoting and inhibiting HIT/e-Health readiness in public healthcare facilities in Ghana. As such, the following five hypotheses were formulated:

> **Hypothesis 1:** *Technological readiness* will have positive impact on the HIT readiness of KATH.
>
> **Hypothesis 2:** *Organizational and cultural readiness* will have positive impact on the HIT readiness of KATH.
>
> **Hypothesis 3:** *Operational resource readiness* will have positive impact on the HIT readiness of KATH.
>
> **H4:** *Regulatory and policy readiness* will have positive effect on the HIT readiness of KATH.
>
> **H5:** *Core readiness* will have positive effect on the HIT readiness of KATH.

10.1 In-depth Interviews discussion

The description of a strategic plan by the respondents appears to imply that it is an “approach that helps people make informed and justifiable decisions that accomplish desired results” (Watkins et al., 2012). This study found that importance of an HIT strategic plan is tied to its ability to execute and yield the necessary outcomes. As such most public hospitals in Ghana are gearing towards the adoption of some form of HIT and preparations are underway. The ultimate goal of IT strategic planning was to provide a broad and stable vision of how IT contributes to the long-term success of the organization (Gunasekaran and Garets, 2004). However, for the strategic plans to be put into action and potential contributions of HIT to manifest themselves, there have to be important organizational, cultural and mindset shifts amongst top management leadership on how IT is perceived in the healthcare environment (Almeida et al., 2017).

As found in this study to achieve target goals in HIT strategic plans, an assessment was necessary to determine the type of health services to deliver using HIT. As such the systems to be implemented, therefore, need to fulfil a range of requirements on a variety of levels. The systems need to be user-friendly (not cumbersome for clinicians) and beneficial for patients, cost-effective for organizations, and interoperable to allow secondary uses of data, (Cresswell and Sheikh, 2013). These functionalities of the system will not only help achieve targets set, but also cement the evidence of HIT effectiveness for future reference.

The findings of this study suggest that with the help of a national coordinating HIT office, information about relevant HIT programs can be made available to assist in future decision-making about HIT adoption. This suggestion confirms the objectives of National Health Services (NHS) Research and Development (R&D) Health Technology Assessment (HTA) which was to ensure that reliable evidence on cost/effectiveness and broader effect of health technologies is produced in the most efficient way for use, manage and provide care in the NHS of the United Kingdom (UK) (McColl et al., 2001). In Ghana, the Office of the National Information Technology Agency (NITA) in Ghana is expected to lead the strategy to increase electronic access to health information, support the development of tools that will enable people to take action with that information, and shift attitudes related to the traditional roles of patients and providers (Ricciardi et al., 2013). A comprehensive needs assessment (including special health characteristics and needs of the population (Mudd-Martin et al., 2014, Turman, 2013) will involve a combination of methods, which allow the organization to "see the full picture" while employing multiple approaches to form a valid and reliable assessment tool

(Lackner, 2015). From the perspective of IT managers, this will help provide some form of impetus among top management in a form of assurance towards achieving set targets.

This study also found that knowledgeable individuals and groups are important ingredients of HIT planning. It is understood that the assurance of the availability of key knowledgeable personnel was necessary for any HIT initiative to be sustainable. However, recognition of IT as integral to improving healthcare delivery services and attractive remuneration packages were crucial to enticing the required skill level in potential employees as suggested by the outcome of this study. This study not only confirms the importance of past performance as a predictor of future performance (Stegers-Jager et al., 2015), but also reveals the importance of the influence of past successes with HIT related initiatives on the ability of available change leaders and multi-layer change teams to successfully sell the concept of HIT initiatives to target stakeholders. These findings have important practical implications.

The Furthermore, this study found that the absence of IT managers in the ranks of the chiefs (C) level impedes the abilities of IT departments to make any effective or meaningful decisions. This finding seems to be suggesting that in the healthcare environment in Ghana and perhaps most developing countries, IT has not yet attained a recognizable poor economic support policies; cultural and educational problems, lack of standards policies; and absence of regulatory policies for long periods (Da et al., 2015). IT governance has emerged as a fundamental business imperative, and rightfully so, because it is key to realizing IT business value (Peterson, 2004). A few top executives made decisions, which subordinates did not question, and boards rubber-stamped decisions (McNurlin and Sprague, 2006). This study found that IT managers in healthcare environment in Ghana were often not allowed to attend heads of departments meetings. Effectively, they did not have any decision-making rights. In contrast, IT governance describes the distribution of IT decision-making rights and responsibilities among different stakeholders in the enterprise, and defines the procedures and mechanisms for making and monitoring strategic IT decisions (Peterson, 2004). The application of Information Technology Governance (ITG) was motivated by the private sector in the 90s, as a way to achieve excellence, provide new services, and increase profitability of IT investments (Al Qassimi and Rusu, 2015). A governance cycle defines who has a decision right (the right and responsibility to make a decision) and an input right (the right to provide input to a decision but not make the actual decision), (McNurlin and Sprague, 2006). As found in the analysis, IT managers in the healthcare domain appear to not have much sway, when it comes to decision-making.

The findings of this study regarding stakeholder engagement suggest that engagement was more about creating awareness among stakeholders in order to gain buy-ins or acceptance for the HIT initiative under consideration. This implies that involving stakeholders from the preliminary stages of the project and considering their feedback could lead to a wider acceptance by sponsors and end-users (healthcare providers and healthcare consumers) respectively. Guided by project planning and change management, core activities of the preimplementation phase of HIT initiatives focus on communication and end-user involvement in workflow redesign and testing (Hartzler et al., 2013).

Although additional research in this field is needed, findings from this study indicate that the majority of providers support using health information technology to share patient information with each other to improve patient care. As such the identification of potential collaborating healthcare facilities as well as internal and external champions were found to be more likely be achieved in the process of active stakeholder engagement. Experience tells us that a successful e-Health system is dependent on the confidence of the stakeholders (Townsend, 2012). The implication of such perceptions amounts to HIT project failures. In this context, this study found that medical and nursing students should be introduced to health informatics courses at some stage in their schooling/training years to familiarise themselves with the systems before they begin their practice as most healthcare providers still view the “full time” computerised entry of patient information as burdensome.

Additionally, what became apparent in this study was that, for HIT to be institutionalized in public healthcare space in Ghana, the type of HIT, including the implementation and quality assurance required to support it, all need to be investigated to assure the continuous availability of systems for use. This was due to the fact that in this research study, technology infrastructure (hardware and software), network facilities necessary for successfully developing and operating an HIT system) were found to be lacking in the rural communities of Ghana (Yusif and Soar, 2014). Due to poor economic and communication infrastructure, most e-Health initiatives are limited to national and provincial/region levels leaving behind majority of health workers living in remote / rural areas (Simba, 2004) even though there are some mHealth projects such as the World Vision’s nation-wide mHealth project for the Ghana Community Health Workers Program. This technology infrastructure predicament presents challenges to collaborations between/among healthcare facilities participating in HIT technologies.

According to this study the successes of HIT were also tied to their flexibility for technical modification to allow integration into existing systems such as the HAMS at KATH and the nation-wide District Health Information Management Systems (DHIMS). In other words, HIT systems must be able to adequately interface with other IT systems and exchange information (Ross et al., 2016), an important feature that promotes acceptance and use.

The problem of skills shortages in HIT is well known (Gregory and Tembo, 2017, Luna et al., 2014b, Yusif and Soar, 2014). The findings from this study suggest further that a lack of understanding and recognition of the potential of IT to help improve healthcare delivery services by leadership in health-related organizations has led to a poor employment structure for IT personnel, effectively not attracting highly skilled IT personnel compared with other industries such as banking. Information gathered from this study blamed the lack of highly skilled IT personnel in the healthcare environment on poor remuneration.

The lack of a proper and reliable policy document was also evident in this study. Despite their promise, many currently unanswered legal and ethical questions threaten the widespread adoption and use of e-Health/EHRs in Ghana and in other developing countries. Key legal dilemmas that must be addressed in the near future pertain to the extent of clinicians' responsibilities for reviewing the entire computer-accessible clinical synopsis from multiple clinicians and institutions, the liabilities posed by overriding clinical decision support warnings and alerts, and mechanisms for clinicians to publically report potential EHR safety issues (Sittig and Singh, 2011). These dilemmas have actually undermined the ability of accountable agencies in Ghana to coordinate the activities of many silos of HIT initiatives currently going on in various parts of Ghana by donor organizations.

Again, the outcome of this study advocates that HITs such as electronic health records (EHRs) that enable health information to be shared electronically offer considerable promise for monitoring and responding to individuals' health behaviour in real time, however, it does also pose a risk of disclosure of patient health information (PHI) without their authorization, especially in societies where patient confidentiality is not strictly monitored. This includes abuses of privacy and confidentiality in the physician-patient relationship as well as autonomy and due process because of access to private EHRs by anonymous researchers, insurance companies, various supervisory agencies and departments (Norman et al., 2011).

In Ghana, the Electronic Communication Act, 2008 (Act 775) Section 4 (2), limits access to electronic personal information of the customers of communications industry. The problem, though, according to this study is the lack of knowledge about patient information legislations and application of ethics by healthcare providers. This is what poses the highest risk to the deployment of HIT in the context of HIT regulations and policy.

The issue of funding for HIT initiatives continues to dominate in both first and third world countries. In developing countries, for a long time now, the lack of funding has borne the brunt of blame for the low HIT adoption rate. While it remains a barrier, the findings from this study appear to suggest that it was more a lack of recognition for IT in the public healthcare environment, corruption, bad leadership and misplaced priorities by people with power, which has led to poor implementation rates

Throughout this study, it was evident that factors which both promote and impede HIT adoption in Ghana abound as can be referenced to in Table 6.5 in Chapter 6.

10.2 Initial Hypotheses testing

In Chapter, 9, the data analysed in SPSS indicated that the null hypotheses for all composite independent variables (Technology readiness, Organizational, cultural readiness, Resource readiness, Regulatory, policy readiness, and Core readiness) were accepted. The implication of the rejection of the null hypotheses (refer to Table 9.18) was an indication of the significant impact of the individual independent variables on the dependent variable, HIT readiness at this initial stage.

The preliminary results from the testing of the initial hypotheses in this study using standard regression suggest that for KATH and public healthcare institutions in Ghana, Technology readiness (TR), Organizational and cultural readiness (OCR), Operational resource readiness (ORR), Regulatory and policy readiness (RPR) and Core readiness (CR) were an integral part of the pathway to effective HIT readiness assessment and implementation. Previous related studies found a lack of ICT infrastructure, basic ICT knowledge/skills, lack of finance and resistance to new technologies (Acquah-Swanzy, 2015) to be impacting on any HIT implementation plans and progress.

Relating to the context of this study, among the top five issues identified by Bedeley and Palvia (2014) in a previous related study, lack of (ICT) infrastructure is ranked the highest relevant issue by both consumers and providers. The remaining four issues include: lack of basic knowledge of ICT; internet inadequacies; financial and sustainability issues; and privacy/security. Similarly, in this research study $P < 0.05$ $t = 17.23$ $\beta = 0.422$ for multiple regression and an *R/Beta* value value of 0.94 for linear regression. This essentially implies that Technology readiness as individual independent component could assess 94% of the overall HIT readiness of a healthcare facility.

As explained in Chapter 9, the beta value is a measure of how strongly each predictor variable influences the criterion (dependent) variable. Likewise, in this research study, patients' privacy and security, initially themed as "Data availability and protection" was part of Regulatory and policy readiness. According to both the linear and multiple regression analyses conducted, regulatory and policy readiness demonstrated a high association with the dependent variable, suggesting that it was necessary for healthcare organizations intending to implement HIT to assess all the identified aspects of this independent variable.

Using Actor-Network theory in analyzing telemedicine deployment at KATH Afarikumah and Kwankam (2013) found that for the system to function, the actors must create awareness of it among all staff. The awareness recommended by Afarikumah and Kwankam in their study was identified as part of Organizational and cultural readiness of public healthcare institutions in Ghana in this study, $P < 0.05$, $t = 8.14$ and $\beta = 0.303$.

As with this study, the potential of an EHR system to transform medical care practice in Ghana has been recognized over the past decades to enhance health care delivery and facilitate decision-making processes (Acquah-Swanzy, 2015, Afarikumah, 2014, Afarikumah and Kwankam, 2013, Ayimbillah et al., 2011, Bedeley and Palvia, 2014, Mensah et al., 2015, Sarfo and Asiedu, 2013, Yusif et al., 2017). Unfortunately, most countries in sub Saharan Africa and other poor nations lack the expertise, funding and ICT infrastructure necessary for the implementation of such modern health care technology to ensure continuity of care. It requires good planning, strong management and physician leadership and supportive staff (Emmanuel, 2012) in the context of the independent variable *Core readiness* in this research study. However, with the lowest beta value of 0.62 in terms of individual correlation with the dependent variable (linear regression), it does still prove to have a strong relationship with the

dependent variable HIT in terms of contributing to assessing overall HIT readiness $P < 0.05$ $t = 5.62$ $\beta = 0.090$ for multiple regression.
The following sections discuss the dependent and independent variables in this study:

10.3 Discussion as relating to literature

10.3.1 e-Readiness

e-Readiness is defined as ‘The degree in which a community is qualified to participate in the Networked World’ (Ghosh Roy and Upadhyay, 2017). If HIT readiness were a door, then e-Readiness would be the keys to open it. Current research suggests that the rate of adoption of health information technology (HIT) is low, and that HIT may not have the touted beneficial effects on quality of care or costs (Karsh et al., 2010). In this research, data analysed have indicated a strong association between various aspects of e-Readiness and the HIT readiness of healthcare institutions. E-readiness assessments are meant to guide development efforts by providing benchmarks for comparison and gauging progress. An e-readiness process based on an objective assessment that leads to sound e-strategies can offer a path for converting good intentions into planned action that brings real change to people's lives (Bridges.org, 2005). Several e-readiness initiatives have been launched to help developing countries in this area, and numerous e-readiness assessment tools have been created and used by different groups, each looking at various aspects of ICT, society and the economy. Most of these efforts nonetheless have yielded meaningful, reliable and lessons-learned outcomes for further progress by many policymakers, leaders in government, business and social organizations, particularly in developing countries.

e-Readiness is that physical infrastructure (high bandwidth, reliability, and affordable prices) integrated with the current ICTs throughout businesses (e commerce, local ICT sector), communities (local content, many organizations online, ICTs used in everyday life, and ICTs taught in schools), and the government (e-government) (Bridges.org, 2005, Khan, 2017)

In the context of HIT, readiness and in this study e-readiness is defined as the availability of and accessibility to reliable ICT physical infrastructure, a mature adaptable organizational culture towards ICT, interaction with the operating environment for resources and planning for future situations. The HIT adoption readiness assessment in this research study was meant to gauge the development effort being made towards the adoption of HIT by public healthcare facilities in Ghana. The qualitative data analysed provided a clear reliable information source about the requirements of e-readiness, to be precise HIT readiness. The assessment of these requirements against public healthcare facilities preparing for HIT/e-Health implementation would provide decision makers with the requisite understanding of the implications of the information collected in an assessment and map out a detailed HIT/ implementation e-strategy. The factors which were found to be strongly influential on the HIT readiness of healthcare organizations according to analysed quantitative data gauging the HIT readiness of KATH are elaborated below:

The success of a technology is not measured by how sophisticated it is, but how simply it merges with social life and derives its value by usage on human life. Thus, the techno-social acceptability of any new "Technology" proves the real value and its reason for existence.

10.3.2 Technological readiness

The success of technology is not assessed on the basis of how complex it is, but how simply it combines with social life and descends its value by usage on human life. Thus, user's active participation in technological integration also holds promises for the e-readiness of the society (Ghosh Roy and Upadhyay, 2017). Technology readiness in this research study considered many dimensions. Given the strong association between technology readiness and HIT readiness in this study, then according to the quantitative data analysed and using concepts developed from the qualitative data analysis, technology readiness can therefore be defined as the availability of and accessibility to physical ICT infrastructure (appropriate Internet connection and bandwidth) and affordable hardware and software capable of being integrated into the healthcare environment. Wholly, these will help in dealing with issues of technology quality, information quality and service quality. The adoption of a D&M IS Model was meant to assess these qualities of technology readiness. Because the information presentation profoundly affects user behaviour and decision-making, it is critical that displays be thoughtfully designed and rigorously tested to ensure they yield the best possible performance outcomes (Karsh et al., 2010).

As found in this study and given the general lack of ICT infrastructure in Ghana (Bedeley and Palvia, 2014, Acquah-Swanzy, 2015, Yusif and Soar, 2014) and across many developing countries, the technological readiness of many countries remains to be seen. The findings of this study suggest that many individual public healthcare facilities in Ghanaian cities appeared to be going paperless in one way or any other. This could not be said of their counterparts in the rural communities in the country. Consequently, medical centres in rural areas are poorly facilitated making it impossible for them to handle the many patients who depend on them ((Kgasi and Kalema, 2014). This finding makes the case stronger for rural medical centres to collaborate with large and well-resourced hospitals to take advantage of any electronic referral systems and information sharing – HIT. One of the cardinal benefits of ICT in health is known to be its potential to break geographical boundaries and as such improve accessibility to healthcare.

The widening ICT gap between urban and rural Ghana was noted in the findings of this study as impeding HIT adoption in the context of collaborations between urban and rural hospitals. As found in some previous related studies, although there are many ongoing projects across Africa that attempt to improve the health sector through the use of ICTs, most remain pilots, few are evaluated and even fewer are designed or assessed for scalability (Shekar and Otto, 2014) because of a lack of proper assessment tools. For healthcare facilities to be technologically ready, there is a need for strong collaboration between hospitals, which could potentially lead to breaking geographical boundaries and increasing access to information and healthcare.

10.3.3 Organizational and cultural readiness

In this research study, healthcare organization and cultural readiness in the context of stakeholder engagement and buy-in and change management, demonstrated a high level of association with HIT readiness. Organizational culture includes an organization's expectations, experiences, philosophy, and the values that guide member behaviour, and is expressed in member self-image, inner workings, interactions with the outside world, and future expectations (gotham Culture, 2017). These organizational expectations, experiences and philosophies could be enhanced when employees or stakeholders are constantly being engaged in new developments in their organizations to adapt to the potential impact any changes might have on the employee. As with the findings of this study, employee participation is argued as being perhaps the most powerful lever management can use to gain acceptance of change (Judson, 1991).

Organizational dimensions surrounding HIT introduction have been the subject of much empirical activity, but progress is hampered by the use of inter-related terms that are often used synonymously (Cresswell and Sheikh, 2013). In this research study, these terms – Engagement and buy-ins and change management, were found to be related, however, with fine distinction. For an effective organizational and cultural assessment, they were found to be contributing strongly according to reliability analyses conducted. Furthermore, organizational and cultural readiness was found to contribute strongly in determining the overall readiness of HIT at the case hospital, KATH. National or provincial e-health initiatives generally not only centre on the advancement of a single healthcare organisation but on the improvement of complete healthcare networks and the community as a whole (Mettler and Vimarlund, 2011).

10.3.4 Operational Resource readiness

Central to the success of any implementation in health informatics is knowledge of the challenges to be faced (Luna et al., 2014a). As the findings of this study suggest, this knowledge is even more important in the context of developing countries, where HIT projects barely continue beyond project phases. This is due to the relative newness of HIT in developing countries and the lack of studies detailing its sustainability. In applying the definition of sustainability by United Nations World Commission on Environment (UNWCE) to health care, Madani and Aronsky (2003) defined sustainability as "the capacity of the health system to function effectively over time with minimum external input. The authors opined that reproducibility, such as integration and application in a variety of different settings is an important characteristic of HIT sustainability.

As this study found, HIT operational resource readiness was gleaned from data analyzed to be dependent on funding and workforce. The majority of previous research including but not limited to Khan et al. (2010); N'Dri (2008); Geissbuhler et al. (2007); Barrington et al. (2010); and Hersh et al. (2010) found the lack of sufficient funding was a major barrier.

The findings of this research study, while partially confirming these previous findings, also found that ICT as an enabling tool in improving healthcare delivery lacked recognition and understanding among the senior leadership of healthcare management. Indeed, corruption and a lack of supporting structures to hire appropriate IT personnel were major impeding factors. As with the findings of this study (Madani and Aronsky, 2003) were also concerned that when addressing the application of IT in healthcare, sustainability can be analyzed through the following factors: 1) efficiency, including factors that affect resource allocation for the development and maintenance of systems, such as user training; 2) financial viability, including cost-effectiveness of applications and return-on-investment in the long-term. The findings of other previous studies suggest low quantities and staffing ratios, job roles, gaps and growth, leadership qualifications, and education and competencies (Hersh, 2010). This study further found that there is a general lack of health informatics education in Ghana as might be the case in other developing countries. As suggested by Hersh (2010), data analyzed also suggests a well-trained HIT professional workforce should have knowledge not only of information technology, but also of healthcare, business and management. In the context of developing countries, it can be seen that substantial numbers of individuals are needed with diverse backgrounds and competencies. Findings such as these underscore the importance of identifying and developing the skills, training, and competencies— consistent with local cultures, languages, and health systems—that will be needed to realize the full benefits of these technologies (Hersh et al., 2010).

10.3.5 Regulatory and policy readiness

Most stakeholders in the health care reform debate endorse adoption of state-of-the-art electronic health record systems (EHRs) with advanced clinical decision support (CDS) (Sittig and Singh, 2011). The legal system, which relies on precedents and lags behind the adoption of new technologies including EHRs, offers little (Bridges.org, 2005) guidance Bridges.org, 2005) to navigate the transition from paper-based to electronic records (Perritt, 2001). Throughout this research study, many challenges arose in the context of HIT use regulatory and policy issues ranging from credentialing of healthcare providers and HIT originating sites and addition to other liability issues. Sittig and Singh (2011) contend that in contrast to paper-based records, documentation-related issues introduce new liabilities to care providers from arbitrary using old patient health information, which may lead to wrong prescriptions being prescribed.

As regulators navigate the proper balance between innovation in the collection of health information and fair data practice controls, policy makers ultimately need to address the broader social consequences of pervasive health information collection, aggregation, and use (Goldstein, 2015). Electronic Health Records (EHRs) are not tied to a single medical institution anymore. Instead, partner or collaborating healthcare institutions may have access to patient data including those with the capacity to maintain HIT systems in the context of third parties/vendors. These enterprises get access to patients' medical data and act as a main point for collecting and disclosing personal data to third parties (Haas et al., 2011). The need to restrict access to patients' health information was acknowledged in this research in addition to the need for healthcare institutions intending to implement HIT to assess their readiness to protect sensitive data with the availability of relevant pieces of legislations.

10.3.6 Core readiness

The purpose of strategy formulation is to help organisations to produce effective decisions which will help shape the nature and direction of e-health within societal, legal, economic, and technological bounds (Mettler and Vimarlund, 2011). It helps in the identification of a range of clinical and non-clinical services to be accomplished using HIT and more importantly and additionally helps in questioning the availability of key leadership capacity in implementing formulated strategies.

The benefits of implementing e-Health can be illustrated by the adoption of an EHR. From a users' perspective, HIT/e-Health has the potential to empower citizens to actively take part in decisions regarding their health, and could be used to track the delivery of recommended preventive care across primary care practices (De Leon and Shih, 2011). One of the main efforts of e-Health in recent years has been to turn all major paper forms into EMR (Mukherjee and McGinnis, 2007).

From the healthcare administration's perspective, HIT/e-Health EHRs can be used to track the delivery of recommended preventive care across small primary care practices serving lower income communities in which few data are generally available for assessing population health (Tang et al., 2007, Weber et al., 2008, Persell et al., 2009, De Leon and Shih, 2011). Effectively, these could enable physicians to improve their quality of patient care, reduce the number of medical errors, and eventually save healthcare costs (Mukherjee and McGinnis, 2007).

HIT/e-Health readiness assessment is therefore defined as the evaluation of healthcare facilities' readiness to adopt and use HIT/e-Health in the context of technological, operational resource, organizational and cultural, regulatory and policy and core readiness both at organizational and environmental levels.

10.3.7 SmartPLS-SEM deployed

An advanced level statistical analysis in SmartPLS 3 is used as an approach to confirm the relationship between the dependent variable Health information technology readiness (HITR) and the independent variables Technology readiness (TR), Operational resource readiness (ORR), Organizational cultural readiness (OCR), Regulatory and policy readiness (RPR), and Core readiness (CR) through SEM confirmatory factor analysis (EFA).

Two important aspects of the research model (refer to Figure 9.2) study were important in the SEM analysis in PLS: (1) measurement fit for the reflective models, which concerns with fit of the outer model; and (2) structural fit, which deals with fit of the structural (inner) model and hypotheses testing (see Table 9.29).

In assessing the outer model of this study, four characteristics were analysed: Unidimensionality; reliability; convergent validity; and discriminant validity. Firstly, unidimensionality, which established that all measurement items were actually measuring their corresponding constructs as they converged with high coefficient above 0.70 and AVE above 0.6. Support was provided for convergent validity when each item had outer/indicator loadings above 0.70 and construct's AVEs were above 0.50 where the AVE was assumed to be equivalent to the communality of a construct (Hair Jr et al., 2016). The discriminant validity of the outer model was assessed using the outer/indicator loadings for all reflective variables (indicators) and actual discriminant validity coefficients (0.544 – 0.860).
More so, the HTMT ratio proposed by Henseler et al. (2015) as a new method of assessing discriminant validity was also taken into account. The HTMT ratio values for all model paths were below 1.0 (ranging from 0.621 to 0.879), which indicate the model was well-fitting (Garson, 2016).
In the second stage, the model's Goodness-of-Fit (GoF) and the research hypotheses were assessed through coefficient determination (R-Square, R^2), the standardized root mean square residual (SRMR), the path coefficient, the model effect size *(f^2)*, and the predictive relevance (Q^2) of the model. While the outcomes of majority tests/analyses in this advanced stage confirmed the early findings, the outcome of the final model appears to support only three (H1, H2 and H3) of the five hypotheses. In other words, the final model did not support H4 and H5 as opposed to the initial outcome of the multiple regression procedure conducted in SPSS earlier.
The path ORR to HITR (t = 4.053) was the strongest of the five, suggesting that for HIT to thrive there is a need for continuous flow of sufficient operational resources in the context of funding and health informatics workforce training. On the contrary, continuous shortage of

operational resources are well known predicaments of HIT/e-Health in developing countries (Barrington et al., 2010, Geissbuhler et al., 2007, Khan et al., 2010, Nabiev et al., 2010).
HIT/e-Health is the use of ICT in healthcare. Therefore, the availability of ICT infrastructure is a core requirement for HIT/e-Health and that has played out in this study given the path TR to HITR (t = 3.091), ranked the second highest among the five. Several researchers such as Yusif and Soar (2014), Gregory and Tembo (2017), Adebesin et al. (2013) all of whom focused on the adoption of ICT in the healthcare environment, identified a lack of ICT infrastructure as one of the leading setbacks in the bid to institutionalize ICT use in healthcare.
Organizational culture (t = 2.885) plays an equally important role in ICT adoption in the healthcare environment (Zakaria et al., 2009). Organizations with cultures that value learning and seek to encourage both individual and organizational learning are often characterized as being more organic (Bangert and Doktor, 2003). In the healthcare environment, healthcare providers have entertained fears in adopting health information technologies as part and parcel of practices which improve healthcare delivery. Among the factors identified by Barzekar and Karami (2014), organizational culture was recognised as having an important to be impacting on the successful implementation of information technology in health systems. Social influences include: subjective norm; competition; supportive organizational culture for change, and friendship network (Li et al., 2013b). The degree of a health care provider's perception of organizational culture (e.g., learning culture) including its supportive elements, influences both implementation and persistence of the work of innovation such as e-Health (Dansky et al., 1999).
Strangely, there was no significant relationship between Core readiness and HITR. Throughout the interviews conducted with IT managers in participating healthcare organizations, the need for some form of strategic plan was apparent. Whilst most of the respondents appeared to suggest the inevitability of HIT strategic plans, perhaps there was a lack of true utilization of such plans. Unlike the striking non-significant association between CR and HITR (t = 1.107), all evidence pointed to the absence of any reliable health information technology policy document against many healthcare facilities going paperless, the T-statistics of 1.322 in the SEM being confirmation of this finding.
The strong relationships between *Regulatory Policy Readiness* and *Operational Resource Readiness* (H12) appears to be suggesting that funding is a prerequisite for any meaningful undertaking in any health policy (Adebayo and Ofoegbu, 2014, Scott and Mars, 2013). There is a corresponding need to look at the long-term effects that extant policies (if any), may have on health IT system resilience, innovation, and related ethical, social/legal issues (McGowan

et al., 2012) in the context of future funding models. Furthermore, the extent to which e-Health operational resources such as availability of funding (Jaana et al., 2011, Eden et al., 2016) and experienced health informaticians (Matar and Alnabhan, 2014) were crucial for successful implementation of e-Health systems was obvious in the path of *Operational Resource Readiness* and *Technology Readiness* (H9). Other indirect effects among independent variables, which exhibited statistically significant relationships were along the paths of *Technology Readiness* and *Organizational Cultural readiness* (H15); *Regulatory Policy Readiness* and *Technology Readiness* (H13); *Regulatory Policy Readiness* and *Organizational Cultural readiness* (H11); and *Organizational Cultural readiness* and *Core Readiness* (H6); *Regulatory Policy Readiness* and *Core Readiness* (H10). As indicate Gholamhosseini and Ayatollahi (2017) the issue of e-Health readiness is complex and affected by many factors, such as ICT infrastructure, policies, human skills, availability and prioritisation of funding, and managers' attitudes towards investment in ICT. Of particular interest was the path of Operational resource readiness and Technology readiness. Generally, in sub-Saharan Africa the problem of financing has been a major setback to the delivery of basic health services (Akosua and Aseweh, 2011) as well as basic ICT infrastructure (Acquah-Swanzy, 2015).

CHAPTER 11: CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH

Overview

Previous chapters have provided relevant information/discussion on the research model adopted. Chapter 10 discussed and interpreted the findings of Chapters 6, 7, and 9 respectively. This chapter sums up findings in the context of context of conclusion, implications, recommendations, limitations and suggestion for future research.

11.0 Introduction

The objective of this research study was to explore participating public healthcare facilities and related organizations the determinants of health information technology (HIT)/e-Health readiness in public healthcare facilities in order to develop a HIT/e-Health readiness assessment model.

Firstly, a systematic literature review was conducted which revealed that Core readiness, Engagement readiness, Technological readiness, HIT funding readiness, Regulatory policy readiness and Workforce readiness were identified and recognised as the most common readiness assessment factors. Furthermore, change management was also found to be relevant when assessing e-Health although it was not assessed in previous readiness assessment studies. In the context of this study, HIT/e-Health has been defined as the delivery and management of health information for and by healthcare providers, receivers and policy makers through the internet, and telecommunications using computers and mobile phones with the hope of increasing and improving healthcare access and services respectively. HIT/e-Health readiness assessment is therefore defined as the evaluation of healthcare facilities' readiness to adopt and use HIT/e-Health in the context of technological, operational resource, organizational and cultural, regulatory and policy and core readiness both at organizational and environmental levels. The outcome of the systematic review was the existence of myriad but fragmented HIT/e-Health assessments factors with no effective measuring tools.

Secondly, the findings of the qualitative study provide a complete understanding of the current state of HIT/e-Health among healthcare facilities in Ghana. The results suggest that there were more factors capable of impeding e-Health adoption than factors capable of promoting e-Health adoption in the country.

Thirdly, the initial survey findings paint a clear picture of the several efforts that individual public healthcare facilities are putting into transforming and improving the quality and accessibility of healthcare in Ghana, defying all odds. The results confirmed that in general, large/teaching public healthcare facilities in the precincts of southern Ghana and in capital cities were more likely to be ready for the implementation of basic HIT/e-Health systems and extending existing related systems to capture patient health information.

Fourthly, the empirical results from the study found that the following predictor variables (factors), namely: technological operational resource; organizational culture; e-Health regulatory policy; and core readiness each have a strong association with the dependent variable HIT/e-Health adoption readiness, assessing 97% of the total HIT/e-Health readiness of healthcare institutions. The finding of this study is also a demonstration of the ability/effectiveness of the model evaluating HIT/e-Health readiness

For effective/reliable e-Health/HIT adoption readiness assessment, an assessment model with an acceptable predictive accuracy is necessary. In this study, PLS-SEM path analysis is used to measure the predictive relevance of a block of manifest indicators of the readiness assessment factors based on a developed HIT/e-Health readiness assessment model Various paths, both direct and indirect have unearthed and mapped the impact of key attributes of e-Health/HIT readiness and adoption. Three important readiness assessment factors are thought to define and predict the structure of the KATH HIT/e-Health readiness survey data: Technology readiness (TR); Operational resource readiness (ORR); and Organizational cultural readiness (OCR). As many public healthcare organizations in Ghana have already transitioned to paperless without any reliable HIT/e-Health guiding policy, there is a critical need for reliable HIT/e-Health regulatory policies readiness (RPR) and some improvement in HIT/e-Health strategic planning readiness (core readiness). The final model (R^2 = 0.558 and Q^2= 0.378) suggests that TR, ORR, and OCR explained 55.8% of the total amount of variance in health information technology/e-Health readiness in the case of KATH. Fit values (SRMR = 0.054; NFI = 0.739). Generally, the GoF for this SEM are encouraging and can substantially be improved. Given the significant association of the SEM variables Technology readiness (TR); Operational resource readiness (ORR) and Organizational cultural readiness (OCR) on health information technology readiness (HITR), the theoretical application of the structural portion of the model, and the collective GoF indices, the SEM is considered to be a good predictor of the underlying HIT/e-Health readiness survey data. As many public healthcare organizations in Ghana have already gone paperless there is a critical need for reliable HIT/e-Health regulatory policies (RPR) and some improvement in HIT/e-Health strategic planning (core readiness).

11.1 Recommendations

The outcome of this research study offers recommendations to public healthcare facilities (hospitals), Ghana health services (GHS), the Ministry of Health (MoH) and the Ministry of Communication (MoC), Ghana in support of their efforts to adopting HIT as interventions to improve healthcare delivery in the country, in the context of designing policies directed at fostering the effective and successful adoption of HIT. The government has been implementing various HIT projects and established an e-Health model since 2005. The government has also established the national information technology agency (NITA).

The study identified a number of factors impeding HIT adoption in Ghana. These factors need to overcome. Notable among these factors are: lack of HIT recognition of the importance of IT in improving healthcare delivery, support of senior management for HIT related projects, regulatory and policy at national level regarding health information sharing and providers' liabilities. It would be wise, therefore, for the government to invest more time and money into reassuring and educating both health practitioners and patients about the integrity of the system, the importance of sharing health information and explicitly note who is responsible for what (Townsend, 2012).

Given that factors capable of impeding HIT adoption in Ghana outweigh those promoting it, implies that greater improvements are vital in order to realise a wider and more successful adoption of HIT in public healthcare facilities in Ghana.
Results from this study suggest that the role of technological readiness, both internal and external in the context of available IT infrastructure and software/hardware availability/affordability is paramount. The onus lies on individual healthcare facilities to ensure that adequate and reliable IT infrastructure for the intended HIT project is in place before proceeding with any advanced decisions.
Furthermore, the readiness of public healthcare facilities in Ghana to implement successful strategies is tied to the availability of operational resource readiness, including sufficient

funding and well-trained IT and health informatics workforce personnel. While technology infrastructure establishes a platform on which HIT/e-Health can be built, the IT workforce provide the knowledge and skills required to implement it. CIOs/heads of IT must also be aware that the readiness of their healthcare organizations may differ depending on the type, size and expected deliverables of the intended HIT to be implemented.

This study also found that organizational culture plays a critical role in the success of HIT adoption readiness. It is therefore recommended that healthcare organizations apply/assess the necessary change management principles and employee/stakeholder engagement including but not limited to teamwork, work climate-morale, information flow, involvement, supervision and meetings. These are the crux of the organizational culture.

Thus, public healthcare facilities intending to implement HIT/e-Health must continue to develop strategies/plans which reflect their current need for such adoption and implementation in order to realise the maximum possible benefit from it.

11.2 Implications

THEORY

This study contributes in several ways to existing literature on HIT/e-Health readiness and adoption by public healthcare organizations in Ghana.

Firstly, this study contributes immensely to the limited existing literature on HIT studies in Ghana and developing countries in at large. It has brought together myriad but fragmented literature on HIT readiness studies and developed indicators/measuring tools to which could be used to improve research on HIT readiness. **Secondly**, several theoretical models have been assessed on their applicability towards investigating factors influencing the healthcare facilities' adoption of IS/HIT. By adopting the Technological-Organisational-Environmental (TOE) framework including parts of the D&M IS Success Model and Stakeholder theory, this study provides evidence for the applicability of multiple theories (Kukafka et al., 2003) for a better understanding of HIT/IS readiness in the healthcare environment. For instance, aspects of the D&M IS Model such as issues with HIT systems, information and service qualities as well as user satisfaction issues. Furthermore, stakeholder theory was used in assessing the extent to which HIT stakeholders were being involved in determining value proposition. Again, the deployment of the Partial Least Squares-Structural Equation Modelling (PLS-SEM), a second-generation statistical analysis fits well in the trend of increased acceptance of PLS-SEM in IS research. Furthermore, the use of SmartPLS 3 allowed for analysing non-linear

relationships between HIT/eHealth adoption readiness and the factors influencing it which fits well with the usual non-linear nature of natural and behavioural phenomena.
Thirdly, the development of complete measuring tools, proven in this study to be measuring the identified HIT readiness factors, is an immense contribution made to literature. Thirdly, this study has emphasized HIT adoption readiness in the context of both ex ante and ex post, a weakness which was identified in the literature as contributing to most HIT failures in developing countries. HIT readiness assessment literature have lacked adequate measuring tools/indicators. So far in literature on the measuring tool developed by (Khoja et al., 2007a).
Fourthly, the empirical study provides improved understanding of the organisational innovation adoption by public healthcare organisations in the context of HIT/e-Health within the wider organisational innovation adoption research purview. **Fifthly**, three additional constructs were developed in addition to technology readiness, regulatory and policy readiness and core readiness. These are: Operational resource readiness; Organizational cultural readiness; and HIT adoption readiness. The extent of readiness is measured on a 1-5 scale corresponding to various stages of HIT readiness progress/stages of healthcare facilities.

PRACTICE

There is a high failure rate with regard to e-Health projects. The National Program for Information Technology (NPfIT) and the gradual implementation of a Personal Demographic Services (PDS) of the UK's NHS demonstrate approximately the many complications that can be encountered in accomplishing HIT/e-Health initiatives. There are also many lessons to still learn from the mistakes of the Information Technology for Economic and Clinical Health Act (the HITECH Act) of the US (Jolly, 2011). **Practically**, this study offers a useful basis for hospital IT heads, senior managers of organizations involved in HIT related projects and management to assess and enhance the conditions under which HIT/eHealth is launched in order to achieve successful and sustainable adoption. First-hand results from the qualitative data collected initially for this study found that specific organisational conditions were associated with higher or lower levels of e-Health adoption. Specifically, this study discovered that a hospital's level of eHealth adoption readiness is greatly impacted by its technological, organizational, operational resource, regulatory and policy and core readiness. With this understanding in mind, strategies can be devised towards improving these factors associated with public healthcare facilities' HIT adoption in Ghana to increase access to and improve healthcare service delivery to patients, especially those who are geographically disadvantaged thereby increasing the chances of project success as well as improving fairness and reducing the digital divide (Khoja et al., 2007a). By acknowledging the complexity and sustainability issues of e-Health implementation especially in resource-constrained situations by researchers and policymakers (Braa et al., 2004, Miscione, 2007) readiness assessment such as this may be valuable for the purposes of policy formulation.

Through this assessment studies, both the factors which promote and which impede HIT adoptions by public healthcare facilities, have been identified. This could provide other benefits to HIT/e-Health decision makers and other stakeholders. These benefits could include: (1) avoiding large losses in time, money and effort; (2) avoiding delays and disappointments among planners, staff and users of services; and (3) facilitating the process of change in the institutions and communities involved, from the stage of pre-contemplation (firmness and resistance to change) through contemplation (acceptance of new ideas) to preparation (preparedness for change) (Khoja et al., 2007a, Prochaska et al., 2001).

11.3 Limitations

Limitations in this research study were noticeable in three areas: methodological, generalizability and theoretical.

11.3.1 Methodology

Firstly, qualitative data was collected from a limited respondents in Ghana. Consequently, the investigation may not necessarily fully capture the perceptions of each participating organization. Nonetheless, as the respondents were Chief Information Technology Officers, Senior Lecturers, Senior Managers and Information Technology Mangers, they were deemed critical decision makers in the HIT/e-Health implementation development – they are believed to be acquainted with HIT/eHealth and associated ideas in their firms – it is presumed that their answers appropriately characterize the organizations in which they work. Again, in the context of the quantitative study, respondents were top administrators/managers and direct system end-users who were believed to have knowledge about the progress being made in their facility towards any HIT/e-Health adoption. Therefore, this study assumes that the responses received are a true reflection of the progress being made in the case hospital in HIT adoption readiness. The self-reported questionnaire (survey) nature of this study is associated to this limitation. There are good reasons to be cautious in the use of self-report questionnaires, but reasons for caution are every bit as important for other methodologies as well (Spector, 1994). As a result, respondents may swell the HIT readiness in order to protect the image of their organizations.

11.3.2 Generalizability

Again, it has to be acknowledged that all the empirical studies were conducted with certain participants in public healthcare facilities in big cities in Ghana. Therefore, a replication or of this study to other parts of Ghana, especially the rural areas and the private healthcare environment must take into consideration the possible differences following the changing cultural, socioeconomic and political backgrounds since healthcare is a much-institutionalised industry. The same caution must be exercised when replicating this study in other developing countries and across the globe. Furthermore, a sample size of 13 for the qualitative study and one hospital for the quantitative study are not ideal in drawing generalizations about the HIT readiness of the whole public healthcare sector in Ghana. HIT/e-Health is a new concept in Ghana as with many developing countries. The newness of this area of study in Ghana limits this study from including a large number of participants, as there are only a handful of individuals/groups within adequate HIT/e-Health related experience. Furthermore, given the evolving complexities in HIT technologies and the general lack of required health informatics skills, caution should be exercised in terms of the level of preparedness required for alternative types of HIT applications other than the one listed in this study.

11.3.3 Future research

In the context of the above findings and limitations this study has informed the suggestion of important future research in the domain of HIT/e-Health adoption in Ghana and in other developing countries. **Firstly**, it would be of great importance for future related studies in this domain to explore the readiness of private healthcare facilities in Ghana to use the HIT/e-Health adoption readiness measurement instruments tools developed here. This will help in re-examining the validity of the measuring tools as well as drawing a line of comparison between the HIT readiness of public and private healthcare facilities respectively. **Secondly**, various analyses of aspects of participants' demographics have revealed some interesting patterns. In view of the lack of studies in this domain focusing on the effect of participants' number of working years and position on HIT/e-Health adoption, a future study focusing on these characteristics would be interesting. This study has also set precedent towards the multiple use of theories/frameworks. Given the evolving complexities of HIT/e-Health and high IT failure rates, future studies are encouraged to integrate multiple theories (as did this study), which prove to have the potential to explain HIT/e-Health adoption readiness. **Lastly**, the socioeconomic and political nature of Ghana is comparable to other sub-Saharan African countries and the majority of third world countries worldwide. Consequently, a two or multiple country study of HIT/e-Health adoption readiness, which evaluates the different relationships between factors affecting public healthcare facilities' HIT/e-Health adoption, would be invaluable and insightful. This would help to investigate whether or not the standard HIT adoption readiness model developed in this study could be generalized/applied in other countries.

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Reference

13 APPENDICES TO THIS THESIS

Appendices

Appendix 1: Sample of participant's invitation letter to participate in this research

University of Southern Queensland

The University of Southern Queensland

HREC Approval Number: **H13REA149**

The Head of Research

KATH

Kumasi

November 17, 2016

Invitation to voluntarily participate in research study

Re: Clinical and non-clinical staff (Administration/Management)

Dear Sir/Madam,

I hereby invite all clinical and non-clinical staff to participate in a PhD research entitled "**Assessing the readiness of public healthcare facilities to adopt health information technology (HIT)/e-Health: a case study of Komfo Anokye Teaching Hospital, Ghana**'. My name is Salifu Yusif. I am PhD student with Faculty of Business, Education, Law and Arts at the University of Southern Queensland Toowoomba.

In this regard, I will be seeking your help/support to collect first-hand data. Your time and help/participation in this regard is highly appreciated.

This research study intends to explore Information and Communication Technology (ICT) readiness of public healthcare institutions in Ghana in the context of e-Health adoption in order to develop a health IT adoption readiness model. This research is important because the model could be useful to healthcare decision makers and governments to make informed decisions about using information and communication technologies to increase access to and improved healthcare service delivery to patients, especially those who are geographically disadvantaged thereby increasing the chances of project success as well as improving fairness and reducing the digital divide and for the purpose of policy formulation. In this research we will be conducting one-on-one interviews with selected authorities and later conduct survey among administration staff, medical doctors and registered nurses. One-on-one interviews will be audio recorded and transcribed for further analysis while information gathered from surveys will be entered into IBM SPSS software for further analysis.

Note: The researcher and/or supervisor intend publishing the results of the research in academic publications (e.g., thesis, journals) and relevant conference(s) and that all data collected (including recorded audio) will be retained for a minimum of five years following the completion of the research/study.

Voluntary Participation

Participation is entirely voluntary. If you decide later to change your mind, you are free to withdraw from the project at any stage. Any information already obtained from you will be destroyed. Your decision whether to take part or not to take part, or to take part and then withdraw will not affect your relationship with the University of Southern Queensland. Please notify the researcher Salifu Yusif through salifusf5@gmail.com or salifu.yusif@usq.edu.au if you decide to withdraw from the study.

Should you have any queries regarding the progress or conduct of this research, you can contact the principal researcher, Salifu Yusif

Salifu Yusif (Student Researcher) University of Southern QLD, West St, Toowoomba 4350 Mob: +61470521113, Tel: +61746311237 salifu.yusif@usq.edu.au	**Dr Abdul Hafeez-Baig (Principal supervisor)** University of Southern QLD, West St, Toowoomba 4350 Tel: +61 4007 46657 Abdul.Hafeez-Baig@usq.edu.au

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer, Office of Research and Higher Degrees, University of Southern Queensland

West Street, Toowoomba 4350, Ph: +61 7 4631 2690, Email: ethics@usq.edu.au

Sincerely Yours,

Salifu Yusif

Appendices

Appendix 2: Participants' information sheet

University of Southern Queensland

The University of Southern Queensland

Participant Information Sheet

HREC Approval Number: **H13REA149**

Student Researcher: Salifu Yusif

Assessing the readiness of public healthcare facilities to adopt health information technology (HIT)/e-Health: a case study of Komfo Anokye Teaching Hospital, Ghana

This research study intends to explore ICT readiness of public healthcare institutions in Ghana in the context of e-Health adoption in order to develop a health IT adoption readiness model. This research is important because the model could be useful to healthcare decision makers and governments to make informed decisions about using information and communication technologies to increase access to and improved healthcare service delivery to patients, especially those who are geographically disadvantaged thereby increasing the chances of project success as well as improving fairness and reducing the digital divide and for the purpose of policy formulation. In this research we will be conducting one-on-one interviews with selected authorities leading initiatives with shared objective of improving healthcare service and delivery through the use of ICT and later conduct survey among administrative staff, medical doctors and registered nurses. One-on-one interviews will be audio recorded and transcribed for further analysis while information gathered from surveys will be entered into IBM SPSS software for further analysis.

This research project will be conducted in selected public hospitals in Ghana and NGOs, which have in any way initiated or implemented any health-related IT. Heads of IT/CIOs leading initiatives of health information technology (HIT), Healthcare providers (Medical doctors and Registered nurses) and laboratory technicians and Administrative staff will be the main participants for data collected.

Note: The researcher and/or supervisor intend publishing the results of the research in academic publications (e.g., thesis, journals) and relevant conference(s) and that all data collected will remain anonymous and no identifiable information either will be published All data collected will be retained for a minimum of five years following the completion of the research/study in accordance with USQ policies and procedures in secure environment.

<u>Voluntary Participation</u>

Participation is entirely voluntary. If you decide during the data collection or later to change your mind, you are free to withdraw from the project at any stage. Any information already obtained from you will be destroyed.

Your decision whether to take part or not to take part, or to take part and then withdraw will not affect your relationship with the University of Southern Queensland. Please notify the researcher Salifu Yusif through salifusf5@gmail.com or salifu.yusif@usq.edu.au if you decide to withdraw from the study.

Should you have any queries regarding the progress or conduct of this research, you can contact the principal researcher:

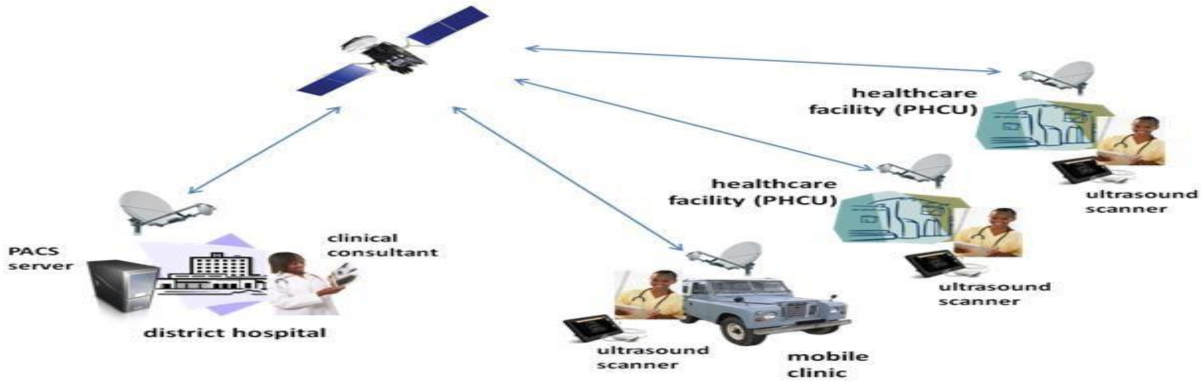
Salifu Yusif

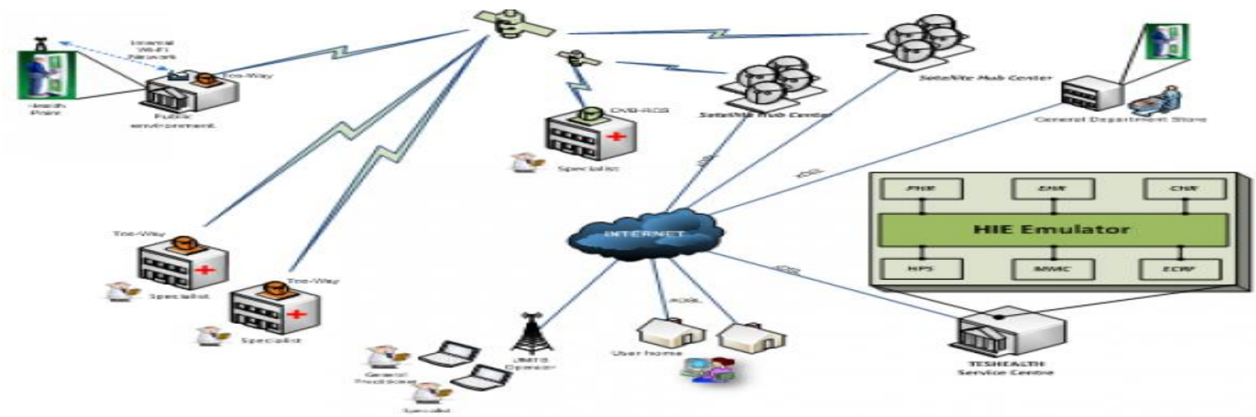
Salifu Yusif (Student Researcher)	**Dr Abdul Hafeez-Baig (Principal supervisor)**
University of Southern QLD, West St, Toowoomba 4350 Mob: +233 54 350 7830/+61470521113; Tel: +61746311237 salifu.yusif@usq.edu.au	University of Southern QLD, West St, Toowoomba 4350 Tel: +61 7 4631 1461 Abdul.Hafeez-Baig@usq.edu.au

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant, please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer, Office of Research and Higher Degrees, University of Southern Queensland

West Street, Toowoomba 4350, Ph: +61 7 4631 2690, Email: ethics@usq.edu.au





Appendix 3: Participants' consent form

University of Southern

The University of Southern Queensland

Consent Form

HREC Approval Number: **H13REA149**

TO: Participants

Full Project Title: Assessing the readiness of public healthcare facilities to adopt health information technology (HIT)/e-Health: a case study of Komfo Anokye Teaching Hospital, Ghana

Student Researcher: Salifu Yusif

- I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.
- I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential. I understand that the recording will be stored by the principal researchers for a minimum of five years following the completion of the research/study and only accessed by the researchers for the purpose of the study.
- I understand that I will be audio-recorded and information recorded will be discarded after five years from the completion of the project.

Name of participant……………………………………………………………......

Signed…………………………………………………….Date……………………….

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant, please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer

Office of Research and Higher Degrees

University of Southern Queensland

West Street, Toowoomba 4350

Ph: +61 7 4631 2690

Email: ethics@usq.edu.au

Appendix 4: Sample of correspondence and response from invited participants

Gmail Fwd: Request for discussion on Research Topic Page 1 of 7

Gmail Salifu Yusif <salifusf5@gmail.com>

Fwd. Request for discussion on Research Topic

1 1 messages

Norbet Yao. Borklo <norbert.borklo@moc.gov.gh> Mon, Jul 22, 2013 at 10:09 PM
Norbet Yao. Borklo

To: salifusf5@gmail.com

Hello Yusif

I forward to you a message from the coordinator of the eGhana project. inclusive is his email and phone numbers. Regards

Norbert Y. Borklo

Ministry of Communications

P. O. Box M38

Accra Ghana

Tel: +233 (0)30 2666465

Fax: +233 (0)30 2667114

Mob: +233 (0)24 2602998

-----Forwarded Message-----

From: "Nelson Osael ' osae@moc.gov.gh>

To: "salifu Yusif' <salifu.yusif@usq.edu.au>, IIVeronica Boateng" boateng@nita.gov.gh>

Cc: 'I norbert borklo" <norbert.borklo@moc.gov.gh>

Sent: Friday, 19 July, 2013 PM

Subject: Request for discussion on Research Topic

Dear Salifu

The Hon Minister of Communications has agreed to your request through Mr Norbert Borklo for permission to talk to a senior official at MOC on key stakeholder's perceptions of Ghana's preparedness for eHealth adoption. I am available for discussions on your topic of study. NITA, an agency of MOC, has already initiated a pilot eHealth initiative together with Ministry of

Health and it will be useful to interact with Mrs Veronica Boateng (+233 20 2050187) Director Apps who is in charge of the programme

Regards
Nelson O. Osae

eGhana Project

Coordinator

Ministry of Communications

https eb317b8b2&j sver=02TpN6W1 LdQ. en.... 25/09/2017 Gmail - Re: Grant of Approval Page 1 of 4

Gmail **Salifu Yusif <salifusf5@gmail.com>**

Re: Grant of Approval

9 messages

Salifu Yusif <salifusf5@gmail.com> Thu, Jul 18, 2013 at 6:49 PM

To: Patrick Dasoberi <pdasoberi@embokauk.com>

Hello Mr Patrick,

It's been a while and guessed you are doing great in all circles. I will be coming home for data collection. I will be interviewing IT/Health IT expert/practitioners. Could you please send me a grant of permission to conduct a research at Emboka Ltd as part of my ethical clearance for my university research office.

Depending on your company policies, you could either edit and sign (digital signature accepted) the attached sample letter and re-mail it back to me or anything of your choice.

Thanking you in advance

Yusif

Appendices

Approval Grant Letter.docx 16K

Salifu Yusif <salifusf5@gmail.com> Mon, Jul 22, 2013 at 9:32 PM

To: Patrick Dasoberi <pdasoberi@embokauk.com>

Hello Mr. Patrick,

This is Yusif. Following our telephonic conversation, i am sending this mail as a follow-up to the previous mail in connection with a grant of approval reply mail to conduct research on e-Health at Emboka Ltd.

Thanking you in advance

Regards,

Yusif

[Quoted text hidden]

Patrick Dasoberi <pdasoberi@embokauk.com> Tue, Jul 23, 2013 at 7:22 PM

To: Salifu Yusif <saIifusf5@gmaiI.com>

This is an official email from emboka Ghana Ltd, the initiators of e-health Ghana Foundation to say that we have given you permission to use our company to conduct your research on e-health in Ghana.

Our understanding is that, this is a research project. If for any other reason, the objective for contacting us on the above subject changes, we would require for you to inform us officially.

Secondly, we will be grateful if you could furnish us with a copy of your research on completion.

Thanks

Patrick Dasoberi

CEO

https eb317b8b2&j sver=02TpN6W 1 LdQ. en.... 25/09/2017

Appendices

Appendix 5: Sample of interview guide

SAMPLE POSSIBLE IN-DEPTH INTERVIEW GUIDE

1. What is your understanding of HIT/e-Health readiness?

2. What in your view/experience should constitute planning for the adoption of information technology (IT) in public hospitals in Ghana?

3. Who are these stakeholders?

4. In what ways do you engage these stakeholders (top management, clinicians, non-clinicians, etc. to participate in IT adoption readiness in the healthcare domain in Ghana?

5. What should we be doing more in as far as stakeholder engagement is concerned?

6. What should we do less in as far as stakeholder engagement is concerned?

7. What should we not do at all in as far as stakeholder engagement is concerned?

8. What is your understanding of organizational culture in the context of the adoption of HIT/e-Health in public healthcare facilities in Ghana?

9. In the context of Ghana, where do we start change management in as far as IT adoption is concerned in the health sector?

10. In what ways do you embark on change management when it comes to HIT/e-Health readiness and adoption issues?

11. What influences will successful change management have on IT adoption in the healthcare sector in Ghana?

12. What is your understanding of value proposition in HIT/e-Health?

13. What value proposition will be most suitable for an e-Health/health information technology (HIT) initiative for public hospitals in Ghana?

14. What do we need to do to embed these value propositions in HIT/e-Health preparations?

15. What impacts will embedding value proposition have on IT adoption in public hospitals in Ghana?

16. With your experience and in your opinion which e-Health service(s) will most be relevant/extremely important in Ghana and why?

17. In as far as hospital organizational IT readiness for adoption is concerned, are there any other issues you would like to point to that have not been covered yet?

18. What relationship exists between ICT units in public hospitals and the national health ICT unit?

19. Context: Infrastructure – access to information and communication technologies

20. Context: A national ICT in health development plan for health sector connectivity and a national policy to reduce the costs of ICT infrastructure were planned for implementation by 2008 (WHO).So far what has happened?

21. Given that there are quite a number of e-health initiatives currently being piloted in Ghana, how far has Ghana come in terms of “enabling environment” to support these initiatives?

22. Talk to me about technology requirements for HIT/e-Health readiness and adoption in the public space.

23. Assuming we have the needed funds skills and technology infrastructure, how do we go about the actual implementation of the HIT/e-Health?

24. What is your understanding of the resources that are needed to be ready when planning for HIT/e-Health implementation?

Appendix 6: Sample survey instrument used for pilot study

PARTICIPANT'S BACKGROUND

Sex: ☐ Male ☐ Female

Institution………………………………………………

Number of years working in e-Healthcare [________] (years)

Current position, specify....................................

Number of years in current position: [________] (years)

PERCEPTION ON HIT READINESS

Instruction: With all the constructs and sub constructs below, please circle the appropriate corresponding number in the columns, which BEST matches your perception/understanding of your institutions IT/e-Health readiness

1 = No, never considered; 2 = No, but have considered; 3 = Yes, in progress; 4 = Yes, nearly completed; 5 = Yes, in place						
	Core readiness					
1	An official document outlining HIT implementation plan is in place.	**1**	**2**	**3**	**4**	**5**
2	A need assessment including special health characteristics and needs of the population has been performed.	**1**	**2**	**3**	**4**	**5**
3	HIT supported services have been determined.	**1**	**2**	**3**	**4**	**5**
4	Staff with relevant knowledge/skills are available.	**1**	**2**	**3**	**4**	**5**
5	Evidence on the practical effectiveness of HIT and lessons learned has been drawn	**1**	**2**	**3**	**4**	**5**
6	An official document outlining HIT implementation plan is in place.	**1**	**2**	**3**	**4**	**5**
7	A need assessment including special health characteristics and needs of the population has been performed.	**1**	**2**	**3**	**4**	**5**
	Organizational cultural readiness					
8	End users have been part of the process of planning	**1**	**2**	**3**	**4**	**5**
9	The hospital has established process used engaging all stakeholders.	**1**	**2**	**3**	**4**	**5**
10	The hospital has identified other interested hospitals collaborators.	**1**	**2**	**3**	**4**	**5**
11	The HIT initiative has been supported by members of the board of directors	**1**	**2**	**3**	**4**	**5**
12	The HIT initiative has been supported by management leadership	**1**	**2**	**3**	**4**	**5**
13	All relevant champions have been identified	**1**	**2**	**3**	**4**	**5**
14	Reliable communication channels have been established	**1**	**2**	**3**	**4**	**5**
15	There are plans for creating awareness	**1**	**2**	**3**	**4**	**5**
16	All relevant stakeholders have been participating in all relevant implementation plans	**1**	**2**	**3**	**4**	**5**
17	The hospital has successfully implemented related systems	**1**	**2**	**3**	**4**	**5**
18	Leaders to foster change management have been identified	**1**	**2**	**3**	**4**	**5**
19	All relevant change management teams have been put in place	**1**	**2**	**3**	**4**	**5**
20	There are plans to manage/deal with anticipated changes to be brought about by the e-Health system deployment	**1**	**2**	**3**	**4**	**5**
21	There are measures in place to collect and evaluate feedback from users	**1**	**2**	**3**	**4**	**5**

	Value proposition readiness					
22	The HIT supports the care delivery mission of the hospital	**1**	**2**	**3**	**4**	**5**
23	The HIT supports the hospital's care delivery plans	**1**	**2**	**3**	**4**	**5**
24	Issues of cultural responsiveness have been considered in the design of the HIT practices.	**1**	**2**	**3**	**4**	**5**
25	All care providers have been licensed/being licensed/trained to provide care through HIT.	**1**	**2**	**3**	**4**	**5**
26	Methods of improving services delivered through HIT are being examined	**1**	**2**	**3**	**4**	**5**
27	Processes to assure patients safety and confidence are in place/being developed	**1**	**2**	**3**	**4**	**5**
28	Opportunities to collaborate with other hospitals/healthcare facilities are in place/being examined	**1**	**2**	**3**	**4**	**5**
	Technological readiness					
29	The types of HIT have been scrutinized, in terms of the functionalities.	**1**	**2**	**3**	**4**	**5**
30	The hospital has identified the medical requirements that have to be met using the HIT.	**1**	**2**	**3**	**4**	**5**
31	The practical viability of the selected HIT has been considered, such as user friendliness of the system for both patients/providers.	**1**	**2**	**3**	**4**	**5**
32	The hospital has assessed the need of the HIT for the serving population	**1**	**2**	**3**	**4**	**5**
33	The hospital has examined the HIT to be implemented in the context of workflow.	**1**	**2**	**3**	**4**	**5**
34	The chosen HIT is interoperable with existing systems in the hospital and other healthcare facilities.	**1**	**2**	**3**	**4**	**5**
35	The availability of Internet has been determined.	**1**	**2**	**3**	**4**	**5**
36	The hardware and software required for the selected e-Health technology is available for purchase.	**1**	**2**	**3**	**4**	**5**
37	The cost of the hardware and software required for the selected e-Health technology would be reasonable	**1**	**2**	**3**	**4**	**5**
38	The service delivery technology/device has been discussed/selected/purchased and tested.	**1**	**2**	**3**	**4**	**5**
39	The service delivery technology/device will meet the hospital's needs for delivering client/patient services.	**1**	**2**	**3**	**4**	**5**
40	Issues of HIT system quality have been discussed/resolved.	**1**	**2**	**3**	**4**	**5**
41	Issues of HIT information quality have been discussed/resolved.	**1**	**2**	**3**	**4**	**5**
42	Issues of HIT service quality have been discussed/resolved	**1**	**2**	**3**	**4**	**5**
43	Issues of HIT system use have discussed/resolved	**1**	**2**	**3**	**4**	**5**
44	Issues of user satisfaction have been discussed/resolved	**1**	**2**	**3**	**4**	**5**
45	Information about deployment plans has be made known to relevant stakeholders.	**1**	**2**	**3**	**4**	**5**
46	The hospital has determined when the system would be implemented.	**1**	**2**	**3**	**4**	**5**
47	A training session for end-users on using the e-Health technology is in place.	**1**	**2**	**3**	**4**	**5**
48	There is a plan to keep stakeholders informed on the progress of the system deployment.	**1**	**2**	**3**	**4**	**5**
49	The types of HIT have been scrutinized, in terms of the functionalities.	**1**	**2**	**3**	**4**	**5**
	Regulatory policy readiness					
50	Issues of liability in the use of the technology has been determined	**1**	**2**	**3**	**4**	**5**
51	The selected e-Health services conform to the NHIS covered scheme/services	**1**	**2**	**3**	**4**	**5**
52	There is available guideline on the use of the technology	**1**	**2**	**3**	**4**	**5**
53	Measures are in place to conform to changing HIT regulations	**1**	**2**	**3**	**4**	**5**
54	Originating and distant site requirements have been identified.	**1**	**2**	**3**	**4**	**5**
55	The chosen HIT to be implemented meet the regulatory framework available	**1**	**2**	**3**	**4**	**5**
56	There are regulation permitting the use of the chosen technology	**1**	**2**	**3**	**4**	**5**
57	The chosen HIT practices are in line with information protection acts	**1**	**2**	**3**	**4**	**5**
58	Patient electronic data protection measures are in place	**1**	**2**	**3**	**4**	**5**
59	Issues of liability in the use of the technology has been determined	**1**	**2**	**3**	**4**	**5**
60	The selected e-Health services conform to the NHIS covered scheme/services	**1**	**2**	**3**	**4**	**5**
61	There is available guideline on the use of the technology	**1**	**2**	**3**	**4**	**5**
62	Measures are in place to conform to changing HIT regulations	**1**	**2**	**3**	**4**	**5**
	Operational resource readiness					
63	The hospital has conducted analysis on the cost/benefit of using HIT services.	**1**	**2**	**3**	**4**	**5**

64	Relevant tools for HIT usage for both care providers and care receivers/patients have been identified	**1**	**2**	**3**	**4**	**5**
65	Continued costs of operating the system have been projected/determined.	**1**	**2**	**3**	**4**	**5**
66	Situations have been developed to test repayment of services delivered through HIT.	**1**	**2**	**3**	**4**	**5**
67	The hospital has determined any projected return/savings on the investment	**1**	**2**	**3**	**4**	**5**
68	The hospital has investigated which services have been covered by the National Health Insurance (NHI) can be delivered by e-Health technologies	**1**	**2**	**3**	**4**	**5**
69	Issues of payment for services delivered through HIT have been resolved	**1**	**2**	**3**	**4**	**5**
70	Issues of eligibility requirement for repayment by NHIS has been determined	**1**	**2**	**3**	**4**	**5**
71	The hospital has determined the availability of the system (sites) for both the general public and care providers	**1**	**2**	**3**	**4**	**5**
72	There are enough skills to successfully implement the HIT system	**1**	**2**	**3**	**4**	**5**
73	Individual and collective roles have been determined	**1**	**2**	**3**	**4**	**5**
74	IT staff are happy to implement the system	**1**	**2**	**3**	**4**	**5**
75	The is a reasonable level of acceptance among users	**1**	**2**	**3**	**4**	**5**
76	Plans are in place to train staff on using the HIT technology to be implemented.	**1**	**2**	**3**	**4**	**5**
77	A cost/benefit analysis of using e-Health technology has been conducted.	**1**	**2**	**3**	**4**	**5**
	Health information technology (HIT)/e-Health readiness					
78	In the context of Core Readiness (CR) for HIT we are ready	**1**	**2**	**3**	**4**	**5**
79	In the context of Organizational Cultural Readiness (OCR) for HIT we are ready	**1**	**2**	**3**	**4**	**5**
80	In the context of Operational Resource Readiness (ORR) for HIT we are ready	**1**	**2**	**3**	**4**	**5**
81	In the context of Regulatory Policy Readiness (RPR) for HIT we are ready	**1**	**2**	**3**	**4**	**5**
82	In the context of Technological Readiness (TR) for HIT we are ready	**1**	**2**	**3**	**4**	**5**

Appendices

Appendix 7: Sample survey instrument used for the actual study

PARTICIPANT'S BACKGROUND

Sex:☐ Male ☐ Female

Institution………………………………………………

Number of years working in e-Healthcare [________] (years)

Current position, specify....................................

Number of years in current position: [________] (years)

PERCEPTION ON HIT READINESS

Instruction: With all the constructs and sub constructs below, please circle the appropriate corresponding number in the columns, which BEST matches your perception/understanding of your institutions IT/e-Health readiness

No.	0 = Don't know; 1 = No, never considered; 2 = No, but have considered; 3 = Yes, in progress; 4 = Yes, nearly completed; 5 = Yes, in place						
	Core readiness						
1	An official document outlining HIT implementation plan is in place.	**0**	**1**	**2**	**3**	**4**	**5**
2	A need assessment including special health characteristics and needs of the population has been performed.	**0**	**1**	**2**	**3**	**4**	**5**
3	HIT supported services have been determined.	**0**	**1**	**2**	**3**	**4**	**5**
4	Staff with relevant knowledge/skills are available.	**0**	**1**	**2**	**3**	**4**	**5**
5	Evidence on the practical effectiveness of HIT and lessons learned has been drawn	**0**	**1**	**2**	**3**	**4**	**5**
6	An official document outlining HIT implementation plan is in place.	**0**	**1**	**2**	**3**	**4**	**5**
7	A need assessment including special health characteristics and needs of the population has been performed.	**0**	**1**	**2**	**3**	**4**	**5**
	Organizational cultural readiness	**0**					
8	End users (doctors, nurses, administrators) are being consulted throughout the HIT preimplementation process	**0**	**1**	**2**	**3**	**4**	**5**
9	The hospital has established process used engaging all stakeholders.		**1**	**2**	**3**	**4**	**5**
10	The hospital has identified other interested hospitals collaborators.	**0**	**1**	**2**	**3**	**4**	**5**
11	The HIT initiative has been supported by members of the board of directors	**0**	**1**	**2**	**3**	**4**	**5**
12	The HIT initiative has been supported by management leadership	**0**	**1**	**2**	**3**	**4**	**5**
13	All relevant champions have been identified	**0**	**1**	**2**	**3**	**4**	**5**
14	Reliable communication channels have been established	**0**	**1**	**2**	**3**	**4**	**5**
15	There are plans for creating awareness	**0**	**1**	**2**	**3**	**4**	**5**
16	All relevant stakeholders have been participating in all relevant implementation plans	**0**	**1**	**2**	**3**	**4**	**5**
17	The hospital has successfully implemented related systems previously	**0**	**1**	**2**	**3**	**4**	**5**
18	Leaders to foster change management among all stakeholders have been identified and they are known	**0**	**1**	**2**	**3**	**4**	**5**

19	All relevant change management teams have been put in place and they are known	**0**	**1**	**2**	**3**	**4**	**5**
20	There are plans to manage/deal with anticipated changes to be brought about by the e-Health system deployment	**0**	**1**	**2**	**3**	**4**	**5**
21	There are measures in place to collect and evaluate feedback from users	**0**	**1**	**2**	**3**	**4**	**5**
	Value proposition readiness						
22	The HIT supports the care delivery mission of the hospital	**0**	**1**	**2**	**3**	**4**	**5**
23	The HIT supports the hospital's care delivery plans	**0**	**1**	**2**	**3**	**4**	**5**
24	Issues of cultural responsiveness have been considered in the design of the HIT practices.	**0**	**1**	**2**	**3**	**4**	**5**
25	All care providers have been licensed/being licensed/trained to provide care through HIT as a way assuring safety and other unforeseeable circumstances.	**0**	**1**	**2**	**3**	**4**	**5**
26	Methods of improving services delivered through HIT are being examined	**0**	**1**	**2**	**3**	**4**	**5**
27	Processes to assure patients safety and confidence are in place/being developed	**0**	**1**	**2**	**3**	**4**	**5**
28	Opportunities to collaborate with other hospitals/healthcare facilities are in place/being examined	**0**	**1**	**2**	**3**	**4**	**5**
	Technological readiness	**0**					
29	The types of HIT have been scrutinized, in terms of the functionalities.	**0**	**1**	**2**	**3**	**4**	**5**
30	The hospital has identified the medical requirements that have to be met using the HIT.	**0**	**1**	**2**	**3**	**4**	**5**
31	The practical viability of the selected HIT has been considered, such as user friendliness of the system for both patients/providers.	**0**	**1**	**2**	**3**	**4**	**5**
32	The hospital has assessed the need of the HIT for the serving population	**0**	**1**	**2**	**3**	**4**	**5**
33	The hospital has examined the HIT to be implemented in the context of workflow improvement/simplification.	**0**	**1**	**2**	**3**	**4**	**5**
34	The chosen HIT is interoperable with existing systems in the hospital and being examined in the context of other healthcare facilities/agencies.	**0**	**1**	**2**	**3**	**4**	**5**
35	The availability of reliable Internet has been determined.	**0**	**1**	**2**	**3**	**4**	**5**
36	The hardware and software required for the selected HIT technology is available for purchase.	**0**	**1**	**2**	**3**	**4**	**5**
37	The cost of the hardware and software required for the selected HIT technology would be reasonable	**0**	**1**	**2**	**3**	**4**	**5**
38	The service delivery technology/device has been discussed/selected/purchased and tested.	**0**	**1**	**2**	**3**	**4**	**5**
39	The service delivery technology/device will meet the hospital's needs for delivering client/patient services.	**0**	**1**	**2**	**3**	**4**	**5**
40	Issues of HIT system quality have been discussed/resolved.	**0**	**1**	**2**	**3**	**4**	**5**
41	Issues of HIT information quality have been discussed/resolved.	**0**	**1**	**2**	**3**	**4**	**5**
42	Issues of HIT service quality have been discussed/resolved	**0**	**1**	**2**	**3**	**4**	**5**
43	Issues of HIT system use have discussed/resolved	**0**	**1**	**2**	**3**	**4**	**5**
44	Issues of user satisfaction have been discussed/resolved	**0**	**1**	**2**	**3**	**4**	**5**
45	Information about deployment plans has be made known to relevant stakeholders.	**0**	**1**	**2**	**3**	**4**	**5**
46	The hospital has determined when the system would be implemented.	**0**	**1**	**2**	**3**	**4**	**5**
47	A training session for end-users on using the e-Health technology is in place.	**0**	**1**	**2**	**3**	**4**	**5**
48	There is a plan to keep stakeholders informed on the progress of the system deployment.	**0**	**1**	**2**	**3**	**4**	**5**
49	The types of HIT have been scrutinized, in terms of the functionalities.	**0**	**1**	**2**	**3**	**4**	**5**
	Regulatory policy readiness						
50	Issues of liability in the use of the technology has been determined	**0**	**1**	**2**	**3**	**4**	**5**
51	The selected e-Health services conform to the NHIS covered scheme/services	**0**	**1**	**2**	**3**	**4**	**5**
52	There is available guideline on the use of the technology	**0**	**1**	**2**	**3**	**4**	**5**
53	Measures are in place to conform to changing HIT regulations	**0**	**1**	**2**	**3**	**4**	**5**
54	Points (sites) of HIT services identified and requirements being examined.	**0**	**1**	**2**	**3**	**4**	**5**
55	The chosen HIT to be implemented meet the regulatory framework available	**0**	**1**	**2**	**3**	**4**	**5**
56	There are regulation permitting the use of the chosen technology	**0**	**1**	**2**	**3**	**4**	**5**
57	The chosen HIT practices are in line with information protection acts	**0**	**1**	**2**	**3**	**4**	**5**
58	Patient electronic data protection measures are in place	**0**	**1**	**2**	**3**	**4**	**5**

59	Issues of liability in the use of the technology has been determined	**0**	**1**	**2**	**3**	**4**	**5**
60	The selected e-Health services conform to the NHIS covered scheme/services	**0**	**1**	**2**	**3**	**4**	**5**
61	There is available guideline on the use of the technology	**0**	**1**	**2**	**3**	**4**	**5**
62	Measures are in place to conform to changing HIT regulations	**0**	**1**	**2**	**3**	**4**	**5**
	Operational resource readiness						
63	The hospital has conducted analysis on the cost/benefit of using HIT services.	**0**	**1**	**2**	**3**	**4**	**5**
64	Relevant tools for HIT usage for both care providers and care receivers/patients have been identified	**0**	**1**	**2**	**3**	**4**	**5**
65	Continued costs of operating the system have been projected/determined.	**0**	**1**	**2**	**3**	**4**	**5**
66	Situations have been developed to test repayment of services delivered through HIT.	**0**	**1**	**2**	**3**	**4**	**5**
67	The hospital has determined any projected return/savings on the investment	**0**	**1**	**2**	**3**	**4**	**5**
68	The hospital has investigated which services have been covered by the National Health Insurance (NHI) can be delivered by e-Health technologies	**0**	**1**	**2**	**3**	**4**	**5**
69	Issues of payment for services delivered through HIT have been resolved	**0**	**1**	**2**	**3**	**4**	**5**
70	Issues of eligibility requirement for repayment by NHIS has been determined	**0**	**1**	**2**	**3**	**4**	**5**
71	The hospital has determined the availability of the system (sites) for both the general public and care providers	**0**	**1**	**2**	**3**	**4**	**5**
72	There are enough skills to successfully implement the HIT system	**0**	**1**	**2**	**3**	**4**	**5**
73	Individual and collective roles have been determined	**0**	**1**	**2**	**3**	**4**	**5**
74	IT staff are happy to implement the system	**0**	**1**	**2**	**3**	**4**	**5**
75	The is a reasonable level of acceptance among users	**0**	**1**	**2**	**3**	**4**	**5**
76	Plans are in place to train staff on using the HIT technology to be implemented.	**0**	**1**	**2**	**3**	**4**	**5**
77	A cost/benefit analysis of using e-Health technology has been conducted.	**0**	**1**	**2**	**3**	**4**	**5**
	Health information technology (HIT)/e-Health readiness	**0**	**1**	**2**	**3**	**4**	**5**
78	In the context of Core Readiness (CR) for HIT we are ready	**0**	**1**	**2**	**3**	**4**	**5**
79	In the context of Organizational Cultural Readiness (OCR) for HIT we are ready	**0**	**1**	**2**	**3**	**4**	**5**
80	In the context of Operational Resource Readiness (ORR) for HIT we are ready	**0**	**1**	**2**	**3**	**4**	**5**
81	In the context of Regulatory Policy Readiness (RPR) for HIT we are ready	**0**	**1**	**2**	**3**	**4**	**5**
82	In the context of Technological Readiness (TR) for HIT we are ready	**0**	**1**	**2**	**3**	**4**	**5**

Appendix 8: Ethics approvals

Gmail - FW: IJSQ HREC HI 3RFJA149 Human Research Ethics Amendment Request. Page 1 of 5

Gmail Salifu Yusif <salifusf5@gmail.com>

FW: USQ HREC H13REA149 Human Research Ethics Amendment
Request #1 Approved

7 messages

Salifu Yusif <Salifu.Yusif@usq.edu.au> Fri, Aug 19, 2016 at 8:47 AM
To: 'I salifusf5@gmail.com" <salifusf5@gmail.com>

From: Human Ethics
Sent: Friday, August 19, 2016 8:47:49 AM
(UTC+IO:OO) Brisbane To: Salifu Yusif
Subject: USQ HREC H13REA149 Human Research Ethics Amendment Request #1 Approved

Dear Salifu

Re: H13REA149 — Key determinants of e-HeaIth readiness of healthcare institutions in Ghana

The Human Research Ethics Committee has recently reviewed your application for amendment to your ethics approval for the above project.

The requested amendments have been approved, effective from 18 August 2016. 1 confirm that your project expiry date is 21 April 2018.

The standard conditions of this approval are:

(a) conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal required by the FIREC

(b) advise (email: ethics@usq.edu.au) immediately of any complaints or other issues in relation to the project which may warrant review of the ethical approval of the project

(c) make submission for approval of amendments to the approved project before implementing such changes

(d) provide a 'progress report' for every year of approval

(e) provide a \final report' when the project is complete

(f) advise in writing if the project has been discontinued.

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Ref: CHRPE/RC/048/17 — 17th February, 20 1 7.

r. Sa li Ill Yusi(
1 1/228
Gladstone
Road Dui ton
Park. QLD
AUSTRALIA.

Deal Sir.

RICVll',W COMMENTS - CONDITIONAL APPROVAL

Protocol TiÍ/e: "Exploring the In/brmaÍi0/1 Technology (IT) Readiness of Public Healthcare Institutions in Ghana ./br e-LIealt/1 Adoption: A IV111/ÍisiÍe kSÍ11(lp o/' Public Hospitals ill Ghana.„

llowing an exped ited review. your protocol was given a conditional approval subject to you add res.si n o the (i) I low i n o concerns/q lie Pies :

on C H Form :

Item 2.4. I. Thisport ion must be m p cted lts Il o u Id be ted.

Kind make lhe necessary amendments and submit one copy each of all required documents to the 'HRPE(Room 7 B lock J. School 0 f Med Sciences, KNUST), a Ion o with a letter explaining the changes vou have made to each document. I he date and relèrence number of this letter shou Id be quoted letter.

Thunk Oil Sir. your appl ication.

YOlli S faith Ill lh.

Osomfo Prof. Sir J. W. Acheampone (VI)

Chairman 'l)

Room 7 Block J, School of Medical Sciences, KNtJST, University Post: Office, Kurnasi, Ghana Phone: +233 3220 63248 Mobile: +233 20 5453785 Email: chrpe.knust.kath@gmail.com / chrpe@knust.edu.gh

Appendix 9: Actual SPSS outputs

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	295	1	2	1.56	.497
Position	292	1	4	2.34	1.302
Valid N (listwise)	290				

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Working yrs * Planning Q1.1	288	96.6%	10	3.4%	298	100.0%
Working yrs * Planning Q1.2	285	95.6%	13	4.4%	298	100.0%
Working yrs * Planning Q1.3	285	95.6%	13	4.4%	298	100.0%
Working yrs * Planning Q1.4	287	96.3%	11	3.7%	298	100.0%
Working yrs * Planning Q1.5	286	96.0%	12	4.0%	298	100.0%
Working yrs * Engage Q2.1	288	96.6%	10	3.4%	298	100.0%
Working yrs * Engage Q2.2	283	95.0%	15	5.0%	298	100.0%
Working yrs * Engage Q2.3	283	95.0%	15	5.0%	298	100.0%

Working yrs * Engage Q2.4	285	95.6%	13	4.4%	298	100.0%
Working yrs * Engage Q2.5	285	95.6%	13	4.4%	298	100.0%
Working yrs * Engage Q2.6	284	95.3%	14	4.7%	298	100.0%
Working yrs * Engage Q2.7	284	95.3%	14	4.7%	298	100.0%
Working yrs * Engage Q2.8	281	94.3%	17	5.7%	298	100.0%
Working yrs * Change Q3.1	284	95.3%	14	4.7%	298	100.0%
Working yrs * Change Q3.2	285	95.6%	13	4.4%	298	100.0%
Working yrs * Change Q3.3	285	95.6%	13	4.4%	298	100.0%
Working yrs * Change Q3.4	285	95.6%	13	4.4%	298	100.0%
Working yrs * Change Q3.5	280	94.0%	18	6.0%	298	100.0%
Working yrs * Change Q3.6	283	95.0%	15	5.0%	298	100.0%
Working yrs * Value Q4.1	281	94.3%	17	5.7%	298	100.0%
Working yrs * Value Q4.2	285	95.6%	13	4.4%	298	100.0%
Working yrs * Value Q4.3	279	93.6%	19	6.4%	298	100.0%
Working yrs * Value Q4.4	285	95.6%	13	4.4%	298	100.0%
Working yrs * Value Q4.5	286	96.0%	12	4.0%	298	100.0%
Working yrs * Value Q4.6	287	96.3%	11	3.7%	298	100.0%
Working yrs * Value Q4.7	284	95.3%	14	4.7%	298	100.0%
Working yrs * Fianance Q5.1	281	94.3%	17	5.7%	298	100.0%
Working yrs * Fianance Q5.2	283	95.0%	15	5.0%	298	100.0%
Working yrs * Fianance Q5.3	280	94.0%	18	6.0%	298	100.0%
Working yrs * Fianance Q5.4	281	94.3%	17	5.7%	298	100.0%
Working yrs * Fianance Q5.5	280	94.0%	18	6.0%	298	100.0%
Working yrs * Reim Q6.1	285	95.6%	13	4.4%	298	100.0%
Working yrs * Reim Q6.2	283	95.0%	15	5.0%	298	100.0%
Working yrs * Reim Q6.3	285	95.6%	13	4.4%	298	100.0%
Working yrs * Reim Q6.4	284	95.3%	14	4.7%	298	100.0%

Working yrs * GathTechInf Q7.1	280	94.0%	18	6.0%	298	100.0%
Working yrs * GathTechInf Q7.2	284	95.3%	14	4.7%	298	100.0%
Working yrs * GathTechInf Q7.3	281	94.3%	17	5.7%	298	100.0%
Working yrs * GathTechInf Q7.4	284	95.3%	14	4.7%	298	100.0%
Working yrs * GathTechInf Q7.5	284	95.3%	14	4.7%	298	100.0%
Working yrs * Tech Infra Q8.2	283	95.0%	15	5.0%	298	100.0%
Working yrs * Tech Infra Q8.3	284	95.3%	14	4.7%	298	100.0%
Working yrs * Tech Infra Q8.4	285	95.6%	13	4.4%	298	100.0%
Working yrs * Tech Infra Q8.5	285	95.6%	13	4.4%	298	100.0%
Working yrs * TechSelect Q9.1	283	95.0%	15	5.0%	298	100.0%
Working yrs * TechSelect Q9.2	286	96.0%	12	4.0%	298	100.0%
Working yrs * TechSelect Q9.3	284	95.3%	14	4.7%	298	100.0%
Working yrs * TechSelect Q9.4	286	96.0%	12	4.0%	298	100.0%
Working yrs * TechSelect Q9.5	285	95.6%	13	4.4%	298	100.0%
Working yrs * TechSelect Q9.6	282	94.6%	16	5.4%	298	100.0%
Working yrs * TechSelect Q9.7	284	95.3%	14	4.7%	298	100.0%

Working yrs * TechSelect Q9.8	285	95.6%	13	4.4%	298	100.0%
Working yrs * PlanImp Q10.1	285	95.6%	13	4.4%	298	100.0%
Working yrs * PlanImp Q10.2	287	96.3%	11	3.7%	298	100.0%
Working yrs * PlanImp Q10.3	285	95.6%	13	4.4%	298	100.0%
Working yrs * Workforce Q11.1	287	96.3%	11	3.7%	298	100.0%
Working yrs * Workforce Q11.2	287	96.3%	11	3.7%	298	100.0%
Working yrs * Workforce Q11.3	287	96.3%	11	3.7%	298	100.0%
Working yrs * Workforce Q11.4	287	96.3%	11	3.7%	298	100.0%
Working yrs * Workforce Q11.5	288	96.6%	10	3.4%	298	100.0%
Working yrs * Workforce Q11.6	287	96.3%	11	3.7%	298	100.0%
Working yrs * Credentialing Q12.1	281	94.3%	17	5.7%	298	100.0%
Working yrs * Credentialing Q12.1a	281	94.3%	17	5.7%	298	100.0%
Working yrs * Credentialing Q12.1b	281	94.3%	17	5.7%	298	100.0%
Working yrs * Credentialing Q12.1c	284	95.3%	14	4.7%	298	100.0%
Working yrs * Credentialing Q12.2	283	95.0%	15	5.0%	298	100.0%

Working yrs * Credentialing Q12.3	283	95.0%	15	5.0%	298	100.0%
Working yrs * Credentialing Q12.4	282	94.6%	16	5.4%	298	100.0%
Working yrs * ProtectInfo Q13.1	283	95.0%	15	5.0%	298	100.0%
Working yrs * ProtectInfo Q13.2	282	94.6%	16	5.4%	298	100.0%
Working yrs * OrgPolicy Q14.1	283	95.0%	15	5.0%	298	100.0%
Working yrs * OrgPolicy Q14.2	284	95.3%	14	4.7%	298	100.0%
Working yrs * OrgPolicy Q14.3	283	95.0%	15	5.0%	298	100.0%
Working yrs * OrgPolicy Q14.4	283	95.0%	15	5.0%	298	100.0%

Working yrs * Planning Q1.1

Crosstab

			Planning Q1.1					Total
			No, never considered	No, but have considered	Yes, in progress	Yes, near completion	Yes, completed	
Position	Nurse	Count	10	8	27	21	25	91
		% within Position	11.0%	8.8%	29.7%	23.1%	27.5%	100.0%

		Residual	2.9	1.3	-6.4	-4.0	6.2	
		Standardized Residual	1.1	.5	-1.1	-.8	1.4	
		Adjusted Residual	1.5	.7	-1.8	-1.2	2.1	
	Lab Tech	Count	1	0	9	9	3	22
		% within Position	4.5%	0.0%	40.9%	40.9%	13.6%	100.0%
		Residual	-.7	-1.6	.9	2.9	-1.5	
		Standardized Residual	-.5	-1.3	.3	1.2	-.7	
		Adjusted Residual	-.6	-1.4	.4	1.5	-.9	
	Medical Dr/Pharmacist	Count	2	3	18	8	5	36
		% within Position	5.6%	8.3%	50.0%	22.2%	13.9%	100.0%
		Residual	-.8	.4	4.8	-1.9	-2.4	
		Standardized Residual	-.5	.2	1.3	-.6	-.9	
		Adjusted Residual	-.5	.3	1.8	-.8	-1.1	
	Administrator	Count	4	5	26	22	12	69
		% within Position	5.8%	7.2%	37.7%	31.9%	17.4%	100.0%
		Residual	-1.4	-.1	.7	3.0	-2.2	
		Standardized Residual	-.6	.0	.1	.7	-.6	
		Adjusted Residual	-.7	.0	.2	1.0	-.8	
Total		Count	17	16	80	60	45	218
		% within Position	7.8%	7.3%	36.7%	27.5%	20.6%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.742[a]	12	.317
Likelihood Ratio	15.076	12	.237
Linear-by-Linear Association	.035	1	.852
N of Valid Cases	218		

a. 5 cells (25.0%) have expected count less than 5. The minimum expected count is 1.61.

Position * Planning Q1.2

Crosstab

			Planning Q1.2					Total
			No, never considered	No, but have considered	Yes, in progress	Yes, near completion	Yes, completed	
Position	Nurse	Count	14	10	23	23	21	91
		% within Position	15.4%	11.0%	25.3%	25.3%	23.1%	100.0%
		Residual	4.4	1.6	-3.4	-8.9	6.3	
		Standardized Residual	1.4	.6	-.7	-1.6	1.7	
		Adjusted Residual	1.9	.8	-1.0	-2.6	2.4	
	Lab Tech	Count	1	1	8	10	2	22
		% within Position	4.5%	4.5%	36.4%	45.5%	9.1%	100.0%

		Residual	-1.3	-1.0	1.6	2.3	-1.5	
		Standardized Residual	-.9	-.7	.6	.8	-.8	
		Adjusted Residual	-1.0	-.8	.8	1.1	-.9	
	Medical Dr/Pharmacist	Count	4	4	11	14	3	36
		% within Position	11.1%	11.1%	30.6%	38.9%	8.3%	100.0%
		Residual	.2	.7	.5	1.4	-2.8	
		Standardized Residual	.1	.4	.2	.4	-1.2	
		Adjusted Residual	.1	.4	.2	.5	-1.4	
	Administrator	Count	4	5	21	29	9	68
		% within Position	5.9%	7.4%	30.9%	42.6%	13.2%	100.0%
		Residual	-3.2	-1.3	1.3	5.2	-2.0	
		Standardized Residual	-1.2	-.5	.3	1.1	-.6	
		Adjusted Residual	-1.5	-.6	.4	1.6	-.8	
Total		Count	23	20	63	76	35	217
		% within Position	10.6%	9.2%	29.0%	35.0%	16.1%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.893[a]	12	.196
Likelihood Ratio	16.488	12	.170
Linear-by-Linear Association	.719	1	.397

N of Valid Cases	217		

a. 5 cells (25.0%) have expected count less than 5. The minimum expected count is 2.03.

Position * Planning Q1.3

Crosstab

			Planning Q1.3					Total
			No, never considered	No, but have considered	Yes, in progress	Yes, near completion	Yes, completed	
Position	Nurse	Count	10	11	30	20	21	92
		% within Position	10.9%	12.0%	32.6%	21.7%	22.8%	100.0%
		Residual	3.7	-.8	4.7	-12.1	4.5	
		Standardized Residual	1.5	-.2	.9	-2.1	1.1	
		Adjusted Residual	2.0	-.3	1.4	-3.5	1.6	
	Lab Tech	Count	0	2	7	11	2	22
		% within Position	0.0%	9.1%	31.8%	50.0%	9.1%	100.0%
		Residual	-1.5	-.8	.9	3.3	-1.9	
		Standardized Residual	-1.2	-.5	.4	1.2	-1.0	

		Adjusted Residual	-1.3	-.6	.5	1.6	-1.1	
	Medical Dr/Pharmacist	Count	4	2	11	14	5	36
		% within Position	11.1%	5.6%	30.6%	38.9%	13.9%	100.0%
		Residual	1.5	-2.6	1.1	1.4	-1.4	
		Standardized Residual	1.0	-1.2	.3	.4	-.6	
		Adjusted Residual	1.1	-1.4	.4	.6	-.7	
	Administrator	Count	1	13	12	31	11	68
		% within Position	1.5%	19.1%	17.6%	45.6%	16.2%	100.0%
		Residual	-3.7	4.3	-6.7	7.3	-1.2	
		Standardized Residual	-1.7	1.4	-1.6	1.5	-.3	
		Adjusted Residual	-2.1	1.9	-2.2	2.2	-.4	
Total		Count	15	28	60	76	39	218
		% within Position	6.9%	12.8%	27.5%	34.9%	17.9%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.924[a]	12	.011
Likelihood Ratio	29.273	12	.004
Linear-by-Linear Association	1.191	1	.275
N of Valid Cases	218		

a. 6 cells (30.0%) have expected count less than 5. The minimum expected count is 1.51.

Position * Planning Q1.4

Crosstab

			Planning Q1.4					Total
			No, never considered	No, but have considered	Yes, in progress	Yes, near completion	Yes, completed	
Position	Nurse	Count	7	14	23	27	20	91
		% within Position	7.7%	15.4%	25.3%	29.7%	22.0%	100.0%
		Residual	1.6	3.2	.1	-9.2	4.2	
		Standardized Residual	.7	1.0	.0	-1.5	1.1	
		Adjusted Residual	.9	1.4	.0	-2.6	1.5	
	Lab Tech	Count	0	1	6	13	2	22
		% within Position	0.0%	4.5%	27.3%	59.1%	9.1%	100.0%
		Residual	-1.3	-1.6	.5	4.3	-1.8	
		Standardized Residual	-1.1	-1.0	.2	1.4	-.9	
		Adjusted Residual	-1.2	-1.1	.2	2.0	-1.1	
	Medical Dr/Pharmacist	Count	3	2	11	15	6	37
		% within Position	8.1%	5.4%	29.7%	40.5%	16.2%	100.0%
		Residual	.8	-2.4	1.7	.3	-.4	
		Standardized Residual	.5	-1.1	.6	.1	-.2	
		Adjusted Residual	.6	-1.3	.7	.1	-.2	
	Administrator	Count	3	9	15	32	10	69
		% within Position	4.3%	13.0%	21.7%	46.4%	14.5%	100.0%
		Residual	-1.1	.8	-2.3	4.6	-2.0	

	Standardized Residual	-.5	.3	-.6	.9	-.6	
	Adjusted Residual	-.7	.4	-.8	1.4	-.8	
Total	Count	13	26	55	87	38	219
	% within Position	5.9%	11.9%	25.1%	39.7%	17.4%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.866[a]	12	.309
Likelihood Ratio	15.714	12	.205
Linear-by-Linear Association	.294	1	.588
N of Valid Cases	219		

a. 6 cells (30.0%) have expected count less than 5. The minimum expected count is 1.31.

Position * Planning Q1.5

Crosstab

			Planning Q1.5					
			No, never considered	No, but have considered	Yes, in progress	Yes, near completion	Yes, completed	Total
Position	Nurse	Count	9	4	32	28	18	91
		% within Position	9.9%	4.4%	35.2%	30.8%	19.8%	100.0%

		Residual	2.7	-2.3	2.4	-4.1	1.3	
		Standardized Residual	1.1	-.9	.4	-.7	.3	
		Adjusted Residual	1.5	-1.2	.7	-1.2	.5	
	Lab Tech	Count	0	3	6	11	2	22
		% within Position	0.0%	13.6%	27.3%	50.0%	9.1%	100.0%
		Residual	-1.5	1.5	-1.2	3.2	-2.0	
		Standardized Residual	-1.2	1.2	-.4	1.2	-1.0	
		Adjusted Residual	-1.3	1.3	-.6	1.5	-1.2	
	Medical Dr/Pharmacist	Count	4	1	16	10	6	37
		% within Position	10.8%	2.7%	43.2%	27.0%	16.2%	100.0%
		Residual	1.5	-1.5	3.9	-3.1	-.8	
		Standardized Residual	.9	-1.0	1.1	-.8	-.3	
		Adjusted Residual	1.0	-1.1	1.5	-1.2	-.4	
	Administrator	Count	2	7	17	28	14	68
		% within Position	2.9%	10.3%	25.0%	41.2%	20.6%	100.0%
		Residual	-2.7	2.3	-5.1	4.0	1.5	
		Standardized Residual	-1.2	1.1	-1.1	.8	.4	
		Adjusted Residual	-1.5	1.3	-1.6	1.2	.6	
Total		Count	15	15	71	77	40	218
		% within Position	6.9%	6.9%	32.6%	35.3%	18.3%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.974[a]	12	.151
Likelihood Ratio	18.688	12	.096
Linear-by-Linear Association	.823	1	.364
N of Valid Cases	218		

a. 7 cells (35.0%) have expected count less than 5. The minimum expected count is 1.51.

SPSS actual output for factor analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	36.466	56.979	56.979	36.466	56.979	56.979	31.834
2	3.862	6.035	63.014	3.862	6.035	63.014	27.462
3	2.660	4.157	67.170	2.660	4.157	67.170	26.385
4	2.023	3.161	70.331	2.023	3.161	70.331	26.069
5	1.527	2.386	72.717	1.527	2.386	72.717	9.235
6	1.161	1.814	74.530	1.161	1.814	74.530	23.255
7	1.008	1.575	76.105	1.008	1.575	76.105	6.101

8	.814	1.271	77.376				
9	.666	1.041	78.417				
10	.641	1.001	79.418				
11	.601	.939	80.357				
12	.576	.901	81.258				
13	.563	.880	82.138				
14	.542	.847	82.985				
15	.524	.818	83.803				
16	.503	.786	84.589				
17	.492	.768	85.357				
18	.469	.733	86.090				
19	.443	.693	86.783				
20	.433	.676	87.459				
21	.397	.620	88.079				
22	.389	.608	88.688				
23	.363	.567	89.254				
24	.352	.550	89.804				
25	.343	.535	90.339				
26	.307	.480	90.819				
27	.304	.475	91.294				
28	.287	.449	91.743				
29	.284	.444	92.187				
30	.278	.434	92.621				
31	.257	.402	93.023				
32	.256	.400	93.423				
33	.239	.373	93.796				
34	.234	.366	94.163				
35	.219	.343	94.505				

36	.215	.336	94.842				
37	.203	.317	95.158				
38	.193	.301	95.460				
39	.187	.292	95.752				
40	.180	.281	96.033				
41	.172	.269	96.302				
42	.165	.258	96.560				
43	.158	.247	96.807				
44	.149	.232	97.039				
45	.144	.225	97.264				
46	.137	.214	97.478				
47	.131	.205	97.683				
48	.129	.202	97.885				
49	.125	.195	98.080				
50	.118	.185	98.265				
51	.111	.174	98.439				
52	.103	.161	98.600				
53	.098	.154	98.754				
54	.096	.150	98.904				
55	.093	.145	99.049				
56	.087	.136	99.186				
57	.086	.134	99.319				
58	.073	.114	99.434				
59	.068	.106	99.540				
60	.068	.105	99.645				
61	.063	.099	99.744				
62	.056	.088	99.832				
63	.054	.085	99.917				

64	.053	.083	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

SPSS actual outputs for reliability analysis

Case Processing Summary

		N	%
Cases	Valid	204	89.5
	Excluded[a]	24	10.5
	Total	228	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.988	.988	63

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.404	3.270	3.549	.279	1.085	.005	63
Inter-Item Correlations	.570	.231	.855	.624	3.701	.014	63

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
GathTechInf Q7.1	211.06	2910.578	.779	.	.988
GathTechInf Q7.2	211.00	2903.498	.819	.	.988
GathTechInf Q7.3	211.06	2907.508	.789	.	.988
GathTechInf Q7.4	211.06	2904.937	.789	.	.988
GathTechInf Q7.5	211.01	2905.034	.804	.	.988
Tech Infra Q8.2	211.11	2906.091	.786	.	.988
Tech Infra Q8.3	211.00	2899.729	.810	.	.988
Tech Infra Q8.4	211.03	2902.965	.812	.	.988
Tech Infra Q8.5	211.07	2899.014	.841	.	.988

TechSelect Q9.1	210.98	2900.197	.794	.	.988
TechSelect Q9.2	211.02	2910.842	.798	.	.988
TechSelect Q9.3	211.09	2902.101	.827	.	.988
TechSelect Q9.4	211.13	2905.383	.794	.	.988
TechSelect Q9.5	211.10	2904.250	.804	.	.988
TechSelect Q9.6	211.06	2901.676	.828	.	.988
TechSelect Q9.7	211.11	2899.919	.818	.	.988
TechSelect Q9.8	211.10	2900.930	.828	.	.988
PlanImp Q10.1	211.04	2905.806	.818	.	.988
PlanImp Q10.2	211.17	2899.069	.823	.	.988
PlanImp Q10.3	211.17	2901.765	.826	.	.988
Fianance Q5.1	210.97	2896.496	.815	.	.988
Fianance Q5.2	210.99	2897.946	.804	.	.988
Fianance Q5.3	211.11	2903.815	.762	.	.988
Fianance Q5.4	211.11	2903.933	.767	.	.988
Fianance Q5.5	211.05	2905.584	.771	.	.988
Reim Q6.1	210.99	2902.424	.794	.	.988
Reim Q6.2	210.93	2901.113	.766	.	.988
Reim Q6.3	210.93	2899.635	.767	.	.988
Reim Q6.4	210.97	2899.324	.785	.	.988
Workforce Q11.1	211.08	2913.840	.707	.	.988
Workforce Q11.2	211.08	2914.634	.700	.	.988
Workforce Q11.3	211.14	2914.044	.664	.	.988
Workforce Q11.4	211.03	2906.723	.753	.	.988
Workforce Q11.5	211.00	2913.567	.685	.	.988
Workforce Q11.6	211.02	2914.664	.689	.	.988
Engage Q2.1	210.96	2917.668	.721	.	.988
Engage Q2.2	211.06	2924.312	.679	.	.988

Engage Q2.3	211.01	2915.167	.763	.	.988
Engage Q2.4	211.11	2917.332	.711	.	.988
Engage Q2.5	211.11	2912.885	.780	.	.988
Engage Q2.6	211.07	2910.163	.761	.	.988
Engage Q2.7	211.04	2906.402	.781	.	.988
Engage Q2.8	211.01	2914.261	.761	.	.988
Change Q3.1	211.04	2904.166	.800	.	.988
Change Q3.2	211.02	2908.532	.784	.	.988
Change Q3.3	211.08	2915.255	.766	.	.988
Change Q3.4	211.11	2908.353	.812	.	.988
Change Q3.5	211.13	2917.239	.787	.	.988
Change Q3.6	211.05	2911.209	.786	.	.988
Credentialing Q12.2	211.18	2910.888	.727	.	.988
Credentialing Q12.3	211.01	2903.517	.804	.	.988
Credentialing Q12.4	211.05	2900.677	.793	.	.988
ProtectInfo Q13.1	210.92	2924.654	.632	.	.988
ProtectInfo Q13.2	210.98	2915.773	.684	.	.988
OrgPolicy Q14.1	211.11	2914.412	.712	.	.988
OrgPolicy Q14.2	211.10	2912.684	.723	.	.988
OrgPolicy Q14.3	211.14	2915.157	.748	.	.988
OrgPolicy Q14.4	211.13	2918.319	.695	.	.988
Planning Q1.1	210.93	2944.167	.479	.	.988
Planning Q1.2	211.01	2937.443	.523	.	.988
Planning Q1.3	210.96	2933.299	.585	.	.988
Planning Q1.4	210.94	2937.642	.550	.	.988
Planning Q1.5	210.90	2940.315	.537	.	.988

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Between People		9680.833	203	47.689		
Within People	Between Items	58.320	62	.941	1.664	.001
	Residual	7113.363	12586	.565		
	Total	7171.683	12648	.567		
Total		16852.516	12851	1.311		

Grand Mean = 3.40

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.570[a]	.523	.620	84.378	203	12586	.000
Average Measures	.988[c]	.986	.990	84.378	203	12586	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.881	.914	5

Inter-Item Correlation Matrix

	Technology readiness	Resource readiness	Organizational cultural readiness	Regulatory and policy readiness	Core readiness
Technology readiness	1.000	.810	.824	.781	.513
Resource readiness	.810	1.000	.716	.735	.445
Organizational cultural readiness	.824	.716	1.000	.757	.644
Regulatory and policy readiness	.781	.735	.757	1.000	.575
Core readiness	.513	.445	.644	.575	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Technology readiness	146.8284	1347.355	.882	.794	.837
Resource readiness	163.0833	1738.234	.810	.685	.832
Organizational cultural readiness	166.9363	1878.030	.850	.758	.823
Regulatory and policy readiness	184.0147	2245.000	.827	.688	.851

Core readiness	196.9412	2691.947	.583	.444	.905

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.596[a]	.537	.655	8.389	203	812	.000
Average Measures	.881[c]	.853	.905	8.389	203	812	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.908	.908	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted

Planning Q1.1	13.84	15.520	.698	.560	.903
Planning Q1.2	13.94	14.345	.819	.708	.877
Planning Q1.3	13.86	14.581	.838	.718	.873
Planning Q1.4	13.80	15.602	.727	.589	.896
Planning Q1.5	13.79	15.396	.764	.604	.889

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Between People		1004.900	218	4.610		
Within People	Between Items	2.986	4	.747	1.768	.133
	Residual	368.214	872	.422		
	Total	371.200	876	.424		
Total		1376.100	1094	1.258		

Grand Mean = 3.46

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.665[a]	.613	.715	10.916	218	872	.000
Average Measures	.908[c]	.888	.926	10.916	218	872	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.971	.971	14

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Engage Q2.1	43.64	152.062	.812	.722	.969
Engage Q2.2	43.77	153.100	.790	.717	.970
Engage Q2.3	43.70	152.549	.820	.734	.969
Engage Q2.4	43.79	152.139	.796	.686	.970
Engage Q2.5	43.80	151.635	.856	.765	.969
Engage Q2.6	43.75	150.356	.854	.770	.969
Engage Q2.7	43.74	149.631	.864	.816	.968
Engage Q2.8	43.70	151.488	.856	.759	.969
Change Q3.1	43.76	150.673	.817	.719	.969
Change Q3.2	43.73	150.384	.842	.753	.969
Change Q3.3	43.76	152.974	.801	.719	.970

Change Q3.4	43.79	151.775	.838	.777	.969
Change Q3.5	43.83	153.521	.827	.761	.969
Change Q3.6	43.77	151.879	.821	.729	.969

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Between People		2671.291	213	12.541		
Within People	Between Items	6.376	13	.490	1.359	.171
	Residual	999.124	2769	.361		
	Total	1005.500	2782	.361		
Total		3676.791	2995	1.228		

Grand Mean = 3.37

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.707[a]	.665	.749	34.757	213	2769	.000
Average Measures	.971[c]	.965	.977	34.757	213	2769	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

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b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.971	.971	15

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Fianance Q5.1	47.71	198.568	.854	.778	.968
Fianance Q5.2	47.73	198.956	.846	.795	.968
Fianance Q5.3	47.84	199.687	.826	.747	.969
Fianance Q5.4	47.84	199.573	.850	.763	.968
Fianance Q5.5	47.80	200.001	.841	.754	.968
Reim Q6.1	47.73	200.171	.847	.784	.968
Reim Q6.2	47.64	199.643	.823	.758	.969
Reim Q6.3	47.65	199.026	.834	.783	.968
Reim Q6.4	47.70	199.027	.848	.798	.968
Workforce Q11.1	47.81	201.917	.794	.690	.969
Workforce Q11.2	47.80	201.925	.795	.750	.969
Workforce Q11.3	47.85	202.887	.717	.601	.970

Workforce Q11.4	47.76	200.421	.838	.810	.968
Workforce Q11.5	47.71	202.473	.758	.649	.970
Workforce Q11.6	47.75	201.468	.783	.693	.969

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Between People		3229.015	211	15.303		
Within People	Between Items	13.867	14	.990	2.208	.006
	Residual	1324.933	2954	.449		
	Total	1338.800	2968	.451		
Total		4567.815	3179	1.437		

Grand Mean = 3.41

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.688[a]	.645	.732	34.120	211	2954	.000
Average Measures	.971[c]	.965	.976	34.120	211	2954	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.981	.981	20

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Between People		4005.420	210	19.073		
Within People	Between Items	11.616	19	.611	1.708	.028
	Residual	1428.134	3990	.358		
	Total	1439.750	4009	.359		
Total		5445.170	4219	1.291		

Grand Mean = 3.38

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.682[a]	.636	.728	20.333	214	1712	.000

Average Measures	.951[c]	.940	.960	20.333	214	1712	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Reliability Statistics

Cronbach's Alpha	N of Items
.881	5

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Between People		121978.502	203	600.879		
Within People	Between Items	306858.231	4	76714.558	1071.068	.000
	Residual	58158.969	812	71.624		
	Total	365017.200	816	447.325		
Total		486995.702	1019	477.915		

Grand Mean = 42.8902

Intraclass Correlation Coefficient

		95% Confidence Interval		F Test with True Value 0			

	Intraclass Correlation[b]	Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.596[a]	.537	.655	8.389	203	812	.000
Average Measures	.881[c]	.853	.905	8.389	203	812	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

SPSS actual outputs for regression analysis

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Technology readiness[b]	.	Enter

a. Dependent Variable: HIT readiness

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.949[a]	.900	.900	3.46983	.900	1824.268	1	202	.000	1.869

a. Predictors: (Constant), Technology readiness

b. Dependent Variable: HIT readiness

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21963.677	1	21963.677	1824.268	.000[b]
	Residual	2432.023	202	12.040		
	Total	24395.700	203			

a. Dependent Variable: HIT readiness

b. Predictors: (Constant), Technology readiness

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.073	.873		8.101	.000		
	Technology readiness	.530	.012	.949	42.711	.000	1.000	1.000

a. Dependent Variable: HIT readiness

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Technology readiness
1	1	1.961	1.000	.02	.02
	2	.039	7.046	.98	.98

a. Dependent Variable: HIT readiness

SPSS actual outputs for correlation analysis

Descriptive Statistics

	Mean	Std. Deviation	N
Technology readiness	67.5403	19.53122	211
Resource readiness	51.1651	15.15093	212
Organizational cultural readiness	47.1168	13.25058	214

Regulatory and policy readiness	30.0093	8.88872	215
Core readiness	17.3059	4.80085	219

Correlations

		Technology readiness	Resource readiness	Organizational cultural readiness	Regulatory and policy readiness	Core readiness
Technology readiness	Pearson Correlation	1	.808**	.826**	.783**	.513**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	211	208	209	210	210
Resource readiness	Pearson Correlation	.808**	1	.719**	.740**	.453**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	208	212	208	211	211
Organizational cultural readiness	Pearson Correlation	.826**	.719**	1	.767**	.664**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	209	208	214	211	213
Regulatory and policy readiness	Pearson Correlation	.783**	.740**	.767**	1	.590**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	210	211	211	215	214
Core readiness	Pearson Correlation	.513**	.453**	.664**	.590**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	210	211	213	214	219

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

Appendices