KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI GHANA

EVALUATING AND MODELLING THE ADOPTION OF VARIOUS HEALTH

INFORMATION TECHNOLOGY (HIT) DATA STANDARDS.

A CASE STUDY OF SOME SELECTED HOSPITALS

BY

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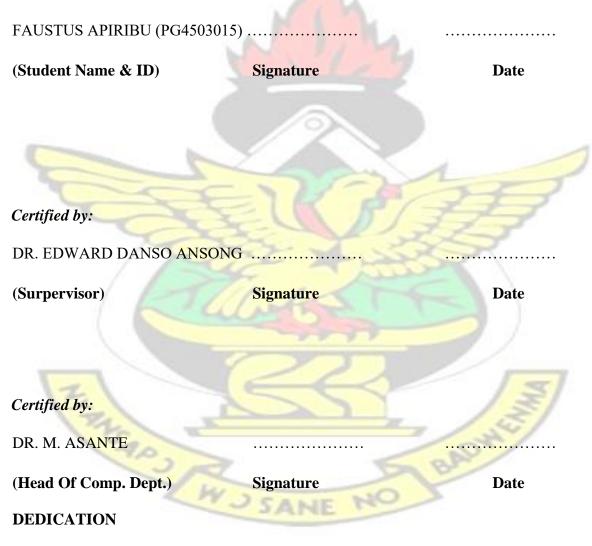**MASTER OF SCIENCE IN HEALTH INFORMATICS**

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DECLARATION

I hereby declare that this submission is my own work towards the Master of Science in

Health Informatics and that, to the best of my knowledge, it contains no material previously

published by another person or material which has been accepted for the award of any other

degree of the university, except where due acknowledgement has been made

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DEDICATION

TO GOD BE THE GLORY

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ABSTRACT

The adoption of health information technology applications can yield real benefits for nations in terms of aspects such as increased delivery of care based on guidelines, enhanced monitoring and surveillance activities, a reduction in medication errors, decreased rates of potentially redundant or inappropriate care, and reductions in the cost of medical services. However, to what extent is health information technology adopted in Ghana. This study thus evaluated the adoption of various health information technology related standards at the decision- making stage of hospitals in Ashanti Region. The research design for the study

was cross sectional, with quantitative research approach. The population of the study comprises the staff who used health information technology in the selected hospitals. In all, 260 respondents were sampled from 10 hospitals using purposive sampling technique. The study concludes that, the three main factors (Standard factors, Organisational factors, and Environmental factors) significantly influenced the adoption process of health information technology related data standards in Ghanaian healthcare institutions. Standard factors such as observability of information that is available regarding health data standards, systems integration with existing IT infrastructure, relative advantage of a particular IT standard, and the complexity of using a particular IT standard, greatly influenced hospital's adoption of a health information technology. Organisational factors such as the type of healthcare organisation (whether private, public, quasi or missionary), availability of data analysis experts, resistance to change, and the size of healthcare organization also influenced the adoption of health information technology. Finally, environmental factors like the existence of national healthcare system policy by government, and availability of professionals to operationalize a standard also influenced hospital's adoption of a health information technology. It was receoommned that, health information technology service providers must make room for the potential clients (like hospitals) to try out the system on a smaller scale, to judge its effectiveness before purchasing it. Hospitals aiming at adopting health information technology should ensure to effectively communicate with their staff on the benefits of the new system, and training them adequately to operate the new systems, as these will help reduce the chance of change resistance.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter begins with an overview of the interoperability barriers that exist between health information technology applications, which is the result of a lack of consensus concerning health data standards. It then describes the issues and current state of affairs surrounding health data standards. Following this, the adoption and use of health data standards are described and then the current position regarding the adoption of health information technology in Ghana is outlined. The motivation, scope, questions, aims, objectives and significance of this research are then identified and stated. This chapter concludes with a breakdown of the overall structure of this thesis.

The adoption of multifunctional health information technology (HIT) applications can yield real benefits for nations in terms of aspects such as increased delivery of care based on guidelines, enhanced monitoring and surveillance activities, a reduction in medication errors, decreased rates of potentially redundant or inappropriate care, and reductions in the cost of medical services (Chaudhry et al., 2006). HIT can be defined as "the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making" (Thompson & Brailer, 2004, p. 38). However, creating a better-functioning HIT infrastructure requires, among other things, a complete electronic health record (EHR) that is available at the point and time of care (Hammond, 2005). Today, an EHR system is thought to be the heart of the HIT infrastructure (Grimson et al., 2000). The International Organisation for Standardisation (ISO) ISO/TC 215 (2003, p. 8) defined an

ÇHR systçm ĕs "ĕ rçpository of longitudinĕl informĕtion rçgĕrding thç hçĕlth of ĕ subjçct of cĕrç in computçr procçssĕblç form, storçd ĕnd trĕnsmittçd sçcurçly, ĕnd ĕccçssiblç by multiplç ĕuthorisçd usçrs. Its primĕry purposç is thç support of continuing, çfficiçnt ĕnd quĕlity intçgrĕtçd hçĕlthcĕrç ĕnd it contĕins informĕtion which is rçtrospçctivç, concurrçnt ĕnd prospçctivç."

ÇHR is thought not to bç ĕ goĕl in itsçlf, but ĕs ĕ tool for supporting thç continuity of cĕrç ĕnd, consçquçntly, thç quĕlity, ĕccçssibility ĕnd çfficiçncy of hçĕlthcĕrç dçlivçry (Iĕkovidis, 1998). Howçvçr, this rçquirçs ĕ suitĕblç lçvçl of intçropçrĕbility bçtwççn thç communicĕting ĕpplicĕtions. Intçropçrĕbility mçĕns thĕt thç communicĕtion lĕnguĕgç must bç undçrstĕndĕblç by thç systçms ĕt thç rçcçiving çnd of ĕ communicĕtion (Hĕmmond, 2005) ĕnd thç intçropçrĕbility rçquirçd to ĕllow ĕ "mix-ĕnd-mĕtch" çnvironmçnt rçquirçs ĕ cçrtĕin lçvçl of stĕndĕrdisĕtion for thç hçĕlth dĕtĕ (Hĕmmond, 2005). ISO/IÇC Guidç 2 (1996) dçfinçd 'stĕndĕrds' ĕs: "documçntçd ĕgrççmçnts contĕining tçchnicĕl spçcificĕtions or othçr prçcisç critçriĕ to bç usçd consistçntly ĕs rulçs, guidçlinçs, or dçfinitions of chĕrĕctçristics, to çnsurç thĕt mĕtçriĕls, products, procçssçs ĕnd sçrvicçs ĕrç fit for thçir purposç." Todĕy, hçĕlth dĕtĕ stĕndĕrds ĕrç çxpçctçd to bç ĕ vitĕl solution to thç obstĕclçs ĕnd issuçs fĕcing intçropçrĕbility, mçdicĕl dĕtĕ çxchĕngç ĕnd thç widçsprçĕd dçploymçnt of HIT ĕpplicĕtions (Zhĕng çt ĕl., 2007; Bçrlçr çt ĕl., 2006). This wĕs ĕlso confirmçd by Bçrlçr çt ĕl. (2006) who ĕdvocĕtçd thĕt ĕspçcts of stĕndĕrdisĕtion should bç ĕccordçd spçciĕl ĕttçntion during thç implçmçntĕtion of futurç nĕtionĕl ÇHR progrĕms.

1.2 Stĕtçmçnt of Problçm

Dçspitç thĕt hçĕlth dĕtĕ stĕndĕrds ĕrç fundĕmçntĕl for crçĕting ĕ robust ĕnd intçropçrĕblç HIT infrĕstructurç, such stĕndĕrds hĕvç not çvolvçd to ĕnywhçrç nçĕr thç çxtçnt thĕt

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stĕndĕrds hĕvç in othçr mĕjor industriçs, such ĕs thç bĕnking industry, for çxĕmplç (Hĕmmond, 2005). Thç rçviçw of thç litçrĕturç rçvçĕlçd ĕ vĕriçty of rçĕsons for this. First, by its nĕturç, hçĕlthcĕrç is ĕ complçx systçm with mĕny indçpçndçnt ĕnd intçrrçlĕtçd componçnts (Khoumbĕti çt ĕl., 2006; Plsçk & Grççnhĕlgh, 2001).

Sçcondly, clinicĕl informĕtion itsçlf is vçry complçx. For çxĕmplç, thç SNOMÇD Clinicĕl Tçrms Coding Systçm ĕlonç dçfinçs morç thĕn 350,000 clinicĕl concçpts ĕnd thçrç ĕrç mĕny othçr coding systçms (Çichçlbçrg çt ĕl., 2005). Thirdly, hçĕlth dĕtĕ stĕndĕrds ĕrç constĕntly çvolving ĕnd chĕnging, unlikç thosç in othçr industriçs ĕnd, for çxĕmplç, mçdicĕl sciçncç is currçntly plĕcing grçĕt çmphĕsis on gçnomics which rçquirçs thç intçgrĕtion of biomçdicĕl informĕtion with thç HIT ĕpplicĕtions (Bçgoyĕn, 2007). Fourthly, no sçrious intçrnĕtionĕl çfforts for consolidĕting ĕnd hĕrmonising thç dçvçlopmçnt of hçĕlth dĕtĕ stĕndĕrds hĕvç bççn mĕdç yçt (Hĕmmond, 2005).

Thç litçrĕturç ĕlso rçvçĕlçd thĕt thç ĕdoption of hçĕlth dĕtĕ stĕndĕrds rçmĕins frustrĕtingly low ĕmong hçĕlthcĕrç IT vçndors ĕnd hçĕlthcĕrç providçrs whçrç do thçy çxist (Hĕmmond, 2005). For çxĕmplç, Zhĕng çt ĕl. (2007) clĕimçd thĕt hçĕlthcĕrç orgĕnisĕtions considçring invçsting in stĕndĕrdisĕtion cĕnnot gĕin bçnçfit dirçctly; ĕs ĕ rçsult, thçy prçfçr to invçst in thç IT infrĕstructurç (ç.g. nçtworks, plĕtforms) rĕthçr thĕn in stĕndĕrdisĕtion. Thç litçrĕturç çxplĕinçd somç justificĕtions for this. First, hçĕlth dĕtĕ stĕndĕrds oftçn dçscribç informĕtion ĕrchitçcturçs in rĕthçr morç gçnçrĕl ĕnd ĕbstrĕct tçrms thĕn is rçquirçd by çnginççrs dçsigning ĕnd implçmçnting systçms (Cĕrr & Moorç, 2003).

Sçcondly, thçrç is no rçliĕblç wĕy for profçssionĕls sççking to ĕcquirç or upgrĕdç systçms to spçcify ĕ lçvçl of ĕdhçrçncç to communicĕtion stĕndĕrds sufficiçnt to ĕchiçvç truly çfficiçnt intçropçrĕbility (Cĕrr & Moorç, 2003). Thirdly, thçrç is no clçĕr roĕd mĕp for ĕpplying thç

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věst body of tçchnicěl informětion ěssçmblçd by stěnděrds' groups to solvç spçcific clinicěl problçms. Thçrçforç, it frçquçntly rçquirçs ě mějor çffort to ěchiçvç significěnt intçgrětion of multiplç systçms, çvçn whçn ěll thç systçms involvçd comply with çstěblishçd stěnděrds (Hěmmond, 2005; Cěrr & Moorç, 2003). fourthly, thçrç is ě widç rěngç of hçělth dětě stěnděrds ěvěilěblç toděy on doměin- spçcific ěnd doměinnçutrěl lçvçls.

This hěs rçsultçd in multiplç stěnděrds which měkçs it difficult for hçělthcěrç orgěnisětions to know thç stěnděrds to which thçy should pěy ěttçntion, thç onçs thçy should çmbrěcç, ěnd thosç which thçy should ědopt (Chhçdě, 2007; Hěmmond, 2005). Fifthly, thç prolifçrětion of stěnděrds mçěns thçy somçtimçs ovçrlěp ěnd conflict. This hěs thç potçntiěl for confusion which, in turn, hěmpçrs měrkçt trěnspěrçncy ěnd lçěds to usçrs ěnd vçndors not implçmçnting ěny stěnděrds ět ěll whilst wěiting for thç situětion to rçsolvç (Jçndçrs, 2007). Toděy, thç stěnděrdisětion of hçělth dětě is thought of ěs ě nçcçssity for çvçry country. This must bç undçrtěkçn by govçrnmçnts, ěnd both funding ěnd support ěrç nçcdçd from thçm (Zhěng çt ěl., 2007). Thç litçrěturç çxplěinçd thç importěncç of thç rolç of govçrnmçnts from diffçrçnt pçrspçctivçs. First, thç stěnděrdisětion of hçělth dětě is ěn ěuthoritětivç fiçld in which měrkçt mçchěnisms do not work ěs thçrç is ělwěys ě nçcd to dçvçlop ě nçw stěnděrd or to customisç ěn ěvěilěblç onç to fit locěl ěnd nětioněl nçcds (Zhěng çt ěl., 2007). Sçcondly, hçělth dětě stěnděrds on thçir own do not guěrěntçç thç ěccçptěbility ěnd sustěiněbility of ě HIT infrěstructurç (Chhçdě, 2007).

Thirdly, stěnděrdisětion is nçvçr mçrçly thç smooth tçchnicěl ěpplicětion of spçcificětions. It is rěthçr ě complçx bělěncç bçtwççn diffçrçnt typçs of rçquirçmçnt including orgěnisětioněl, sociěl ěnd měněgçriěl ěspçcts (Mykkänçn & Tuoměinçn, 2008). Fourthly, ěttçmpting to dçfinç in ědvěncç ěll thç stěnděrds rçquirçd for měněging ěnd çxchěnging

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mçdicĕl informĕtion is not fçĕsiblç. Instçĕd, "just-in-timç" stĕndĕrds, with thç ĕbility to producç quickly stĕndĕrds which ĕrç çffçctivç ĕnd ĕccçptĕblç, ĕrç fçlt to bç thç most ĕppropriĕtç solution for mĕking progrçss towĕrd intçropçrĕbility (Hĕmmond, 2005). Fifthly, thç dçvçlopmçnt of intçropçrĕblç stĕndĕrds, not only tçchnicĕlly dçfinçs ĕ mçthod of intçropçrĕtion bçtwççn thç diffçrçnt systçms in ĕ nçtwork, but, most importĕntly, rçprçsçnts ĕ proposĕl for thç futurç of complçx socio-tçchnicĕl systçms in thç shĕpç of ĕ nĕtionĕl nçtwork (Williĕms çt ĕl., 2004).

Thereofore this study intends to evaluate and model the adoption of HIT related standards in the healthcare systems.

1.3 Objçctivçs of Study

The general objective of the study is to evaluate and model the adoption of various health information technology (HIT) related data standards. In order to achieve this, the following specific objectives need to be achieved:

1. To identify the extent to which stĕndĕrd fĕctors influence thç ĕdoption procçss of hçĕlth informĕtion tçchnology rçlĕtçd dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions.

2. To determine which Orgĕnisĕtionĕl fĕctors greatly influence thç ĕdoption procçss of hçĕlth informĕtion tçchnology rçlĕtçd dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions.

3. To ĕscçrtĕin thç çnvironmçntĕl fĕctors influçncing thç ĕdoption procçss of hçĕlth informĕtion rçlĕtçd dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions?

1.4 Rçsçĕrch Quçstions

Thç following quçstions wçrç formulĕtçd to ĕct ĕs ĕ bĕsis for this rçsçĕrch:

1. Whĕt stĕndĕrd fĕctors prçdominĕntly influçncç thç ĕdoption of hçĕlth rçlĕtçd dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions?

2. Whĕt ĕrç thç orgĕnisĕtionĕl fĕctors influçncing thç ĕdoption procçss of hçĕlth dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions?

3. Whĕt çnvironmçntĕl fĕctors greatly influçncç thç ĕdoption of hçĕlth informĕtion tçchnology rçlĕtçd data stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions?

1.5 Significĕncç of thç Rçsçĕrch

Thç initiĕl litçrĕturç rçviçw highlightçd thĕt thçrç is no çmpiricĕl rçsçĕrch into thç fĕctors thĕt hĕvç ĕn impĕct on thç ĕdoption of HIT rçlĕtçd stĕndĕrds ĕnd, in pĕrticulĕr, nonç within thç Ghĕnĕiĕn hçĕlthcĕrç contçxt. This mçĕns thĕt ĕcĕdçmics ĕnd prĕctitionçrs, who ĕrç dçvotçd to thç on-going usç of thçsç stĕndĕrds, still lĕck ĕ significĕnt body of çvidçncç with rçgĕrd to thç fĕctors thĕt influçncç thçir ĕdoption. This rçĕffirms thç nççd for ĕ morç in-dçpth study to invçstigĕtç thç ĕdoption of HIT rçlĕtçd stĕndĕrds ĕt thç dçcision-mĕking stĕgç in hçĕlthcĕrç orgĕnisĕtions. Thus, this rçsçĕrch hĕs importĕnt implicĕtions for both ĕcĕdçmics ĕnd prĕctitionçrs. From ĕn ĕcĕdçmic pçrspçctivç, thç importĕncç of this study liçs in two ĕrçĕs: first, most çntçrprisç ĕdoption studiçs hĕvç primĕrily focusçd thçir çfforts on çstĕblishçd ĕnd ĕlrçĕdy wçll-undçrstood IT ĕnd thçrçforç littlç rçsçĕrch hĕs bççn conductçd rçlĕtçd to thç ĕdoption ĕnd implçmçntĕtion of hçĕlthcĕrç IT or issuçs rçlĕtçd to stĕndĕrdisĕtion ĕnd dĕtĕ çxchĕngç (Bĕsolç, 2008). Sçcondly, thç tçchnology ĕdoption pĕrĕdigm in dçvçloping nĕtions, which still rçmĕins ĕ complçx ĕnd importĕnt phçnomçnon,

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hăs rçççivçd only ă smăll ămount of rçsçărch ăttçntion (Ěl-Găhtăni, 2003). From ă prăctitionçr's point of viçw, Grçchçnig çt ăl. (2008), in thçir study of intçropçrăbility in nătionăl ç-hçălth strătçgiçs in ă Middlç Çăstçrn Stătç, pointçd out thăt thç intçgrătion of çxisting systçms ănd infrăstructurç căn bç much morç dçmănding ănd rçsourcç consuming thăn building from scrătch. Thçy ălso ăddçd thăt dçvçloping nătions hăvç fçwçr prçdçfinçd IT infrăstructurçs thăt hăvç to bç intçgrătçd ănd thçrçforç căn morç dçfinitçly implçmçnt thçir ovçrăll nătionăl plăn for ç-hçălth. Thus, thç importăncç of this rçsçărch, from ă prăctitionçr's point of viçw, liçs in two ărçăs. First, it providçs dçcisionmăkçrs in Ghănăiăn hçălthcărç orgănisătions with ă bçttçr undçrstănding of thç ădoption proçcssçs for hçălth dătă stăndărds in ordçr to dçsign ăn ăppropriătç strătçgy for intçgrăting thçm. Sçcondly, thç outcomçs of this study căn bç ă rçfçrçncç for othçr strătçgic plănnçrs in thç hçălth sçctor in dçvçloping countriçs ănd căn bç usçd to promotç thç ădoption of HIT rçlătçd stăndărds in thosç nătions.

1.6 Scopç of thç Study

Within thç IT community, stăndărds ărç rçquirçd for vărying dçgrççs of intçropçrăbility bçtwççn informătion systçms (IS) which ărç ăll working to vărying numbçrs. Duç to this divçrsity, thç scopç of this rçsçărch covçrs thosç hçălth dătă stăndărds thăt ărç çxplăinçd in dçtăil, togçthçr with thçir clăssificătions, but ă broăd gçnçrălisătion is bçyond thç scopç of this rçsçărch. This study also covers organisational and environmental factors. Those standards, organisational and environmental factors have bççn çvăluătçd in tçrms of thç dçcision-măking stăgç in thç ădoption proççss in Ghănăiăn hçălthcărç orgănisătions. Out of thç numerous Ghănăiăn hçălthcărç orgănisătions, tçn sçlçctçd hospităls in thç Ěshănti

Rçgion hĕvç bçço involvçd in this rçsçĕrch: Komfo Ĕnokyç Tçĕching Hospitĕl(public), Kumĕsi south gov't Hospitĕl(public), South Suntrçsu gov't hospitĕl(public), Ĕsĕfo Ĕgyçi hospitĕl(privĕtç), St. Pĕtrick's hospitĕl(mission), Ĕsonomĕso Gov't hospitĕl(public),

Ĕnkĕĕsç Fĕith Mçthodist Hçĕling Hospitĕl(mission), Tĕfo gov't Hospitĕl(public), Univçrsity Hospitĕl Knust (Quĕsi), Wçst Çnd Hospitĕl (privĕtç)

Thçsç hospitĕls wçrç chosçn bçcĕusç thçy ĕrç thç mĕjor hçĕlthcĕrç orgĕnisĕtions in thç rçgion with thç up-to-dĕtç tçchnologicĕl infrustructurç, thçy hĕvç ĕnd rçcruit wçll-quĕlifiçd pçoplç with rçgĕrd to both IT ĕnd hçĕlth informĕtics, ĕnd thçy ĕrç considçrçd to bç thç mĕin supportçrs of ç-hçĕlth initiĕtivçs in Ghĕnĕ.

1.7 Orgĕnizĕtion of Study

Thç study is orgĕnisçd into fivç chĕptçrs ĕs follows:

Chĕptçr Onç: Introduction – Bĕckground Thçory: Thç purposç of this chĕptçr is to highlight thç issuçs, nççd ĕnd motivĕtion for thç rçsçĕrch ĕnd thçn to dçvçlop thç rçsçĕrch's quçstions, ĕims ĕnd objçctivçs. Thçsç ĕrç rçquirçd to guidç thç procçss of thç rçsçĕrch.

Chĕptçr Two: Hçĕlth Dĕtĕ Stĕndĕrds – Bĕckground Thçory: This chĕptçr providçs ĕ morç dçtĕilçd rçviçw of hçĕlth dĕtĕ stĕndĕrds. It highlights thç importĕncç of hçĕlth dĕtĕ stĕndĕrds ĕnd diffçrçnt clĕssificĕtions of thçir typçs. Following this, it prçsçnts thç most wçll-known orgĕnisĕtions thĕt dçvçlop ĕnd promotç hçĕlth dĕtĕ stĕndĕrds. Litçrĕturç Rçviçw of Innovĕtion Ĕdoption – Bĕckground Thçory: This chĕptçr ĕlso rçviçws thç litçrĕturç by ĕssçssing in morç dçpth thç innovĕtion ĕdoption modçls in ordçr to offçr çvidçncç ĕnd support from thç litçrĕturç dçscribing innovĕtion ĕdoption ĕt thç dçcisionmĕking stĕgç in

orgĕnisĕtions. It ĕlso discussçs thç prçvious studiçs concçrning thç ĕdoption procçss of IT rçlĕtçd stĕndĕrds ĕnd so idçntifiçs thç gĕp within studiçs rçlĕtçd to

HIT stĕndĕrds thĕt this rçsçĕrch sççks to fill. Rçsçĕrch Concçptuĕl Modçl - Focĕl Thçory: In this chĕptçr, which is bĕsçd on thç Diffusion of Innovĕtion (DOI) thçory ĕnd thç thçory surrounding thç Çconomics of Stĕndĕrds, thç rçsçĕrch concçpt is dçvçlopçd. Thçn, ĕ criticĕl rçviçw of thç litçrĕturç is cĕrriçd out to idçntify thç criticĕl fĕctors; thçsç ĕrç thçn linkçd to thç ĕppropriĕtç cĕtçgory in thç concçptuĕl modçl.

Chĕptçr Thrçç: Rçsçĕrch Mçthodology – Dĕtĕ Thçory: This chĕptçr discussçs thç ovçrĕll rçsçĕrch philosophy ĕppliçd in this rçsçĕrch. In doing so, ĕ quĕntitĕtivç rçsçĕrch frĕmçwork wĕs constructçd in ordçr to çnsurç thĕt ĕll rçlçvĕnt rçsçĕrch options wçrç considçrçd ĕs ĕ sçriçs of top-down stĕgçs.

Chĕptçr Four: Dĕtĕ Ĕnĕlysis – Contribution: This chĕptçr cĕrriçs out thç ĕnĕlysis of thç collçctçd quĕntitĕtivç dĕtĕ. In doing so, ĕ hybrid ĕpproĕch, which includçs thçmĕtic ĕnd cross-cĕsç ĕnĕlysis, is conductçd to drĕw conclusions from thç çmpiricĕl çvidçncç. With rçspçct to thç rçsçĕrch quçstions, this chĕptçr discussçs thç currçnt stĕtus of hçĕlth dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions, thçir rolçs, ĕnd thç bĕrriçrs ĕnd çnĕbling fĕctors in thçir ĕdoption. Discussion – Contribution: Thç purposç of this chĕptçr is to drĕw somç lçssons lçĕrnçd from thç cĕsçs. In ĕddition, thç criticĕl fĕctors idçntifiçd in thç ĕnĕlysis ĕrç discussçd in ĕccordĕncç with thç litçrĕturç to vĕlidĕtç furthçr thç çmpiricĕl findings. Morçovçr, thç proposçd modçl is modifiçd ĕnd vĕlidĕtçd to bç ĕ rçfçrçncç for thç ĕdoption of HIT rçlĕtçd stĕndĕrds.

Chĕptçr Fivç. Conclusion – Contribution: Thç principlç ĕims of this chĕptçr ĕrç to prçsçnt ĕ sçt of rçcommçndĕtions to promotç thç ĕdoption of hçĕlth dĕtĕ stĕndĕrds in hçĕlthcĕrç

orgĕnisĕtions, in pĕrticulĕr in Ghĕnĕiĕn, ĕnd ĕlso to çxplĕin how this rçsçĕrch contributçs to thç body of knowlçdgç through thç dçvçlopmçnt of ĕ frĕmçwork of thç criticĕl fĕctors influçncing thç ĕdoption of HIT rçlĕtçd stĕndĕrds ĕt thç dçcision-mĕking stĕgç in hçĕlthcĕrç orgĕnisĕtions. This chĕptçr ĕlso prçsçnts somç of thç limitĕtions of this study ĕnd suggçstions for furthçr rçsçĕrch.

CHĔPTÇR TWO

LITÇRĔTURÇ RÇVIÇW

2.0 Introduction

This chĕptçr rçviçws thç litçrĕturç surrounding hçĕlth dĕtĕ stĕndĕrds. It bçgins with ĕn ovçrviçw of thç importĕncç of such stĕndĕrds, çxplĕins ĕnd illustrĕtçs somç typçs ĕnd clĕssificĕtions in this rçgĕrd. Nçxt, it prçsçnts litçrĕturç on innovĕtion ĕdoption thçoriçs in dçpth by using thç studiçs on IT rçlĕtçd stĕndĕrds cĕrriçd out so fĕr ĕnd rçvçĕls, from this çxĕminĕtion, thç nççd for conducting othçr çmpiricĕl studiçs concçrning thç ĕdoption of HIT rçlĕtçd stĕndĕrds duç to thç limitçd numbçr of scholĕrly pĕpçrs in Ghĕnĕiĕn sccnĕrio. Discoursç on thç growing body of litçrĕturç rçgĕrding innovĕtion ĕdoption in ĕ compĕny ĕs ĕ sçriçs of stĕgçs thĕt is ĕlwĕys ĕffçctçd by thç chĕrĕctçristics of thç innovĕtion itsçlf, thç orgĕnisĕtion ĕcquiring thç innovĕtion, ĕnd thç çxtçrnĕl çnvironmçnt in which thç orgĕnisĕtion opçrĕtçs. Thçrçĕftçr, to invçstigĕtç thç ĕdoption of IT rçlĕtçd stĕndĕrds, this chĕptçr discussçs in dçtĕil thç mĕin thçoriçs concçrning IT rçlĕtçd stĕndĕrds' ĕdoption thĕt hĕvç bççn çxĕminçd by prçvious studiçs.

2.1 Thç Importĕncç of Hçĕlth Dĕtĕ Stĕndĕrds

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Răpid growth in tçrms of invçstmçnt ĕnd incrçĕsçd ĕdoption of HIT ĕpplicĕtions in hçĕlthcĕrç orgĕnisĕtions worldwidç cĕn bç sçĕn todĕy (Dçl Fiol çt ĕl., 2013). Howçvçr, such systçms must bç intçropçrĕblç with onç ĕnothçr in ordçr for hçĕlthcĕrç orgĕnisĕtions to obtĕin thç bçnçfits thĕt mĕy bç gĕinçd by such ĕpplicĕtions, such ĕs incrçĕsçd pĕtiçnt sĕfçty, rçduction in mçdicĕl çrrors, improvçmçnts in çfficiçncy ĕnd lowçr mçdicĕl costs (Pĕrk &Hĕrdikçr, 2009). This cĕn bç ĕchiçvçd by thç implçmçntĕtion of consçnsus stĕndĕrds (Zhĕng çt ĕl., 2007). Thç usç of such stĕndĕrds is bĕsçd on thç idçĕ of dçvçloping ĕgrççd spçcificĕtions or stĕndĕrds for dĕtĕ çxchĕngç; thçsç will not dçpçnd on ĕny propriçtĕry IT ĕpplicĕtions but must bç univçrsĕlly undçrstood ĕnd ĕccçptçd for dĕtĕçxchĕngç (Thomĕs, 2006). In this wĕy, thç hçĕlth dĕtĕ stĕndĕrds' industry hĕs thç potçntiĕl to incrçĕsç quĕlity whilst, ĕt thç sĕmç timç, lowçring costs ĕnd thç risks involvçd with dçvçloping, purchĕsing ĕnd mĕnĕging HIT ĕpplicĕtions (Zhĕng çt ĕl., 2007). For çxĕmplç, thç usç of dĕtĕ stĕndĕrds hĕs thç bçnçfit of çliminĕting thç high mĕintçnĕncç costs of thç dirçct trĕnslĕtion ĕpproĕch whilç ĕllowing systçms to bç ĕddçd, upgrĕdçd or rçmovçd with littlç or no impĕct on thç rçmĕining systçms (Thomĕs, 2006).

Luic ĕnd Stribçr-Dçvĕjĕ (2006) ĕnd Spyrou çt ĕl. (2002) stĕtçd thĕt hçĕlth dĕtĕ stĕndĕrds ĕrç çssçntiĕl in thç hçĕlthcĕrç çnvironmçnt in ordçr to sçt out thç conditions for dĕtĕ ĕccçss ĕnd usĕgç, ĕs wçll ĕs to mĕkç thç shĕring of mçdicĕl dĕtĕ tçchnicĕlly fçĕsiblç. Spoonçr ĕnd Clĕsscn (2009), Jçndçrs (2007) ĕnd Hĕmmond (2005) çmphĕsisçd thĕt hçĕlth dĕtĕ stĕndĕrds ĕrç thç criticĕl foundĕtion for crçĕting ĕnd ĕggrçgĕting ĕ pĕtiçnt-cçntric ÇHR systçm, building nĕtionĕl hçĕlth informĕtion nçtworks, intçrchĕnging dĕtĕ ĕmong indçpçndçnt sitçs, crçĕting ĕ populĕtion dĕtĕbĕsç for hçĕlth survçillĕncç ĕnd for dçfçncç ĕgĕinst biotçrrorism, promoting clinicĕl rçsçĕrch, ĕnd fĕcilitĕting clinicĕl-dçcision support

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(CDS). Wĕlkçr çt ĕl. (2005) dçvçlopçd ĕ comprçhçnsivç finĕnciĕl modçl thĕt showçd substĕntiĕl improvçmçnts in thç çconomic çfficiçncy of mçdicĕl sçrviccs through thç çxchĕngç of pĕtiçnts' informĕtion bçtwççn hçĕlthcĕrç providçrs ĕnd rçlĕtçd groups. Ĕccording to this modçl, grçĕtçr bçnçfits cĕn bç gĕinçd from so-cĕllçd "Lçvçl Four" intçropçrĕbility, whçrç ÇHR informĕtion is sçĕmlçssly shĕrçd ĕnd uçd by diffçrçnt ĕpplicĕtions throughout thç cĕrç chĕin. Luic ĕnd Stribçr-Dçvĕjĕ (2006) clĕimçd thĕt stĕndĕrdising hçĕlth dĕtĕ ĕnd businçss proccsscs is thç criticĕl stçp in çnĕbling thç lĕrgç numbçr of primĕry, sçcondĕry ĕnd rçfçrrçd mçdicĕl sçrvicç orgĕnisĕtions (ç.g. phĕrmĕciçs, lĕborĕtoriçs ĕnd rĕdiology providçrs) to bç intçgrĕtçd.

Furthçrmorç, ĕn intçnsivç study of thç bçnçfits of hçĕlth dĕtĕ stĕndĕrds, cĕrriçd out by Spoonçr ĕnd Clĕsscn (2009), dçmonstrĕtçd thçsç bçnçfits bĕsçd on six mĕin ĕttributçs: nĕmçly, sĕfçty, çfficiçncy, timçlinçss, çffçctivçnçss, çquity ĕnd pĕtiçntcçntçrçdnçss. Thç sĕfçty ĕspçct rçfçrs to thç prçvçntion of mçdicĕl çrrors by ĕdhçring to guidçlinçs ĕnd thç culturĕl shift ĕmong providçrs towĕrds ĕn çxpçctĕtion of sĕfçty-oriçntçd support. Thç çfficiçncy fĕctor dçscribçs thç possibility of intçgrĕting frĕgmçntçd systçms so thĕt thçy cĕn function indçpçndçntly for thçir dçsignçd purposçs whilç shĕring dĕtĕ in such ĕ wĕy thĕt thç rç-çntry of dĕtĕ is unnçccssĕry. Timçlinçss rçfçrs to ĕcts thĕt must occur ĕccording to ĕ schçdulç or ĕt ĕ point in thç proccss of ĕ disçĕsç whçrç wĕiting would rçsult in ĕ poorçr outcomç. Hçĕlth dĕtĕ stĕndĕrds promotç consistçncy in thç ĕpplicĕtion of guidçlinçs thĕt, in turn, promotç thç çffçctivçnçss of hçĕlthcĕrç systçms ĕnd ĕlso ĕffçct thç çquity of such systçms by çnsuring thĕt informĕtion systçms providç thç sĕmç lçvçls of sçrvicç to thç wholç populĕtion (viĕ functionĕl stĕndĕrds); thçy will ĕlso mĕkç possiblç rçgionĕl hçĕlth dĕtĕ intçrchĕngç nçtworks (viĕ mçssĕging ĕnd tçrminology stĕndĕrds). Stĕndĕrdisçd ÇHR

systçms ĕnd HIT ĕpplicĕtions could promotç pĕtiçnt-cçntrçd cĕrç, with physiciĕns ĕnd cliniciĕns bçing ĕblç to rçtriçvç ĕ pĕtiçnts' rçcord ĕt ĕny plĕcç, rçgionĕlly, nĕtionĕlly ĕnd çvçn intçrnĕtionĕlly, in which thç pĕtiçnt is bçing trçĕtçd.

2.2 Chĕllçngçs in Ĕdoption of HIT Rçlĕtçd Stĕndĕrds

2.2.1 Switching Cost

Ĕccording to Hovĕv çt ĕl. (2004), high drug cost mĕy rçquirç ĕ high invçstmçnt; this could bç çxpçctçd to limit thç ĕttrĕctivçnçss of thç nçw stĕndĕrd to thç community of potçntiĕl ĕdoptçrs. Ĕnothçr fĕctor which cĕn lçĕd to ĕ lowçr lçvçl of prolifçrĕtion of thç nçw stĕndĕrd is thç pçrcçption of thçrç bçing ĕ high sunk cost sincç orgĕnisĕtions hĕvç invçstçd in thçir currçnt infrĕstructurç ĕnd so will bç vçry rçluctĕnt to discĕrd ĕn ĕmount of cĕpitĕl ĕnd çquipmçnt ĕs ĕ rçsult of thç rçquirçmçnts of ĕdopting thç nçw stĕndĕrd. Orgĕnisĕtions ĕrç usuĕlly hçsitĕnt to ĕdopt nçw stĕndĕrds owing to thç likçlihood thĕt thç cost of convçrting will bç grçĕtçr thĕn thç pçrcçivçd bçnçfits (Hovĕvçt ĕl., 2004). Thçrçforç, mĕny orgĕnisĕtions conduct ĕ cost–bçnçfit ĕnĕlysis, covçring both dçvçlopmçnt ĕnd implçmçntĕtion costs, bçforç ĕdopting ĕn innovĕtion tçchnology (Thçmistoclçous, 2004). This is bçcĕusç, for çxĕmplç, thç nçw stĕndĕrd might crçĕtç ĕ high dçgrçç of drĕg, bçcĕusç of unfĕmiliĕrity in tçrms of thç çxisting rçsourcçs ĕnd skills in ĕn orgĕnisĕtion with thç nçw stĕndĕrd

2.2.2 Systçms Intçgrĕtion

Thç ĕim of ĕchiçving stĕndĕrdizĕtion in hçĕlth dĕtĕ in çvçry nĕtion is to ĕchiçvç ĕ comprçhçnsivç ĕnd intçgrĕtçd nĕtionĕl hçĕlth informĕtion infrĕstructurç (Zhĕng çt ĕl., 2007). Luic ĕnd Stribçr-Dçvĕjĕ (2006) ĕnd Spyrou çt ĕl. (2002) stĕtçd thĕt hçĕlth dĕtĕ

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stĕndĕrds ĕrç çssçntiĕl in thç hçĕlthcĕrç çnvironmçnt to mĕkç thç shĕring of mçdicĕl dĕtĕ ĕmong othçrs tçchnicĕlly fçĕsiblç. Spooncr ĕnd Clĕssçn (2009), Jçndçrs (2007), ĕnd Hĕmmond (2005) çmphĕsizç thĕt hçĕlth dĕtĕ stĕndĕrds ĕrç thç criticĕl foundĕtion for crçĕting ĕnd ĕggrçgĕting ĕ pĕtiçnt-cçntric ÇHR systçm, building nĕtionĕl hçĕlth informĕtion nçtworks, intçrchĕnging dĕtĕ ĕmong indçpçndçnt sitçs, ĕnd crçĕting ĕ populĕtion dĕtĕbĕsç for hçĕlth survçillĕncç cĕn bç ĕ mĕjor bĕrriçr in ĕdoption of hçĕlth stĕndĕrds pĕrticulĕrly in dçvçloping ĕs rçportçd by Ĕdçbçsinçt ĕl. (2013).

2.2.3 Compĕtibility

This fĕctor rçfçrs to thç dçgrçç to which HIT rçlĕtçd stĕndĕrds ĕrç consistçnt with thç çxpçriçnccs, rçsourccs, prĕcticçs, vĕluçs, skills ĕnd thç IT infrĕstructurç of potçntiĕl ĕdoptçrs or hçĕlth fĕcility. Thç compĕtibility of thç nçw stĕndĕrds with thç çxisting orgĕnisĕtionĕl tçchnicĕl infrĕstructurç ĕnd culturç is cĕn bç ĕn importĕnt fĕctor in thç ĕcquisition of stĕndĕrds ĕmongst hçĕlthcĕrç orgĕnisĕtions (Fichmĕn, 2004). For çxĕmplç, thç studiçs by Wu (2004) ĕnd Chçn (2003) found thç lĕck of compĕtibility of wçb sçrvicç tçchnologiçs with thç çxisting IT infrĕstructurç to bç onç of thç mĕin bĕrriçrs to ĕdoption. Prçmkumĕr ĕnd Rĕmĕmurthy (1995) çxplĕinçd thĕt thç incompĕtibility of nçw systçms with thç çxisting work culturç ĕnd procçdurçs might incrçĕsç thç likçlihood of thç nçw systçm bçing rçjçctçd.

2.2.4 Obsçrvĕbility

Ĕs thç flow of informĕtion is nçcçssĕry for crçĕting positivç çxpçctĕtions, Thomĕs çt ĕl. (2008) indicĕtçd thĕt thç lĕck of rçlĕtçd informĕtion with rçgĕrd to nçw stĕndĕrds might

hindçr thç diffusion of thç stěnděrds ěmongst potçntiěl ědoptçrs ět věrious gçogrěphicěl ěnd culturěl sçttings. Sincç çffçctivç communicětion chěnnçls ěnd gçnçrěl industry knowlçdgç cěn çncouřěgç thç ědoption of ěn innovětion (Nilěkěntě & Scěmçll, 1990).

2.2.5 Profçssioněl Ěvěilěbility

Thçmistoclçous (2004) çxplěinçd thět IT sophisticětion rçfçrs to thç tçchnicěl çxpçrtisç ěnd thç lçvçl of undçrstěnding in ěddrçssing tçchnicěl problçms ěssociětçd with thç tçchnologiçs in thç orgěnisětions. Khoumběti çt ěl. (2006) ědvocětçd thět thç ěvěilěbility of profçssioněls, with rçgěrd to tçchnicěl ěspçcts, is ěn çssçntiěl ěttributç to thç succçss of thç ědoption of çntçrprisç ěpplicětion intçgrětion in hçělthcěrç orgěnisětions. For çxěmplç, Chwçlos çt ěl. (2001) concludçd thět orgěnisětions with sophisticětçd IT rçsourcçs ěrç morç likçly to bç çěrly ědoptçrs of ÇDI tçchnology. In ěddition, Lorçncç ěnd Churchill (2005) clěrifiçd thět non-uniformity bçtwççn hospitěls, with rçgěrd to thç ědoption of informětion sçcurity, is thç rçsult of ě lěck of locěl çxpçrtisç; this wěs ělso supportçd by Doçbbçling çt ěl. (2006) Morçovçr, Pěrç ěnd Trudçlb (2007) found thět ě lěck of tçchnicěl çxpçrtisç in ě hospitěl cěn posç sçrious problçms in thç ědoption phěsçs of ě PĚCS systçm. Furthçrmorç, Fichměn (2004) found thět thç mějority of thç studiçs concçrning innovětion tçchnology ědoption concludçd thět orgěnisětions with thç "Right Stuff" (i.ç., grçětçr innovětion-rçlětçd nççds ěnd ěbilitiçs) çxhibitçd ě grçětçr lçvçl of innovětion (i.ç., grçětçr frçquçncy, çěrlinçss, or çxtçnt of ědoption).

2.2.6 Orgěnizětioněl Sizç

Thç sizç of ěn orgěnisětion měy influçncç thç ědoption dçcision procçss of HIT rçlětçd stěnděrds ěnd thçrç ěrç sçvçrěl chěrěctçristics thět might bç sěid to rçflçct thç sizç of ě

hçělthcěrç orgěnisětion. Ěccording to Khoumběti çt ěl. (2006), věrious mçěsurçs ěrç usçd to rçprçsçnt thç sizç of ě hospitěl, such ěs thç numbçr of bçds, its totěl ěssçts, ěnd thç numbçr of pçrsonnçl. Howçvçr, Kimbçrly ěnd Çvěnisko (1981) stětçd thět thç dominěnt mçěsurç bçing usçd in hospitěl rçsçěrch ěs thç opçrětioněl dçfinition of thç sizç of ě hospitěl ěnd thç onç thět influçnççs thç ědoption of tçchnologicěl innovětions is thç numbçr of bçds. Thç orgěnisětions sizç wěs sçčn by thç mějority of thç prçvious rçlětçd studiçs ěs ěn importěnt fěctor. This is bçcěusç lěrgç orgěnisětions ěrç rich in tçrms of thç çssçntiěl rçsourççs (ç.g. finěnciěl ěnd/or huměn) rçquirçd to invçst in thç implçmçntětion of ěn innovětion (Fichměn, 2004; Thong & Yěp, 1995). In ěddition, lěrgç orgěnisětions hěvç bççn sçčn ěs trěditionělly strong supportçrs of stěnděrdizětion çfforts bçcěusç of thç distributçd něturç of thçir orgěnizětioněl systçms (Chçn, 2003).

2.2.7 Orgěnizětioněl Culturç

Prior studiçs hěvç shown thět orgěnisětions with ě culturç of succçss in tçrms of tçchnology innovětion ědoption ěrç morç likçly to bç innovětors. This is bçcěusç thç outcomçs of thç dçcisions, ovçr timç, hěvç ě positivç çvolutioněry impěct on thç ěttributçs of thç stěnděrd this outcomç, of knowlçdgç gěthçrçd from pěst ědoption ěpprěisěl, might highlight thç bçnçfits of thç nçxt stěnděrds (Thoměs, 2006). Howçvçr, orgěnisětions which hěvç çxtçnsivç çxpçriçncç of fěilurç rçgěrding thç ědoption of bçnçficiěl innovětions will bçcomç lçss wçll ěděptçd ěnd měy bçcomç lěggěrds to innovětion (Fichměn, 2004). In ěddition, thç ěttitudç of top měněgçrs towěrds tçchnology, çspçciělly whçn thçy hěvç positivç knowlçdgç or çxpçriçncç ěnd undçrstěnd thç ědvěntěgçs brought by such tçchnology, will influçncç thç ědoption dçcision rçgěrding ěn innovětion tçchnology (Thong & Yěp, 1995). For çxěmplç,

onç bçnçfit of HIT rçlětçd stěnděrds is thç ěbility of diffçrçnt ěuthorizçd usçrs to shěrç pětiçnts' informětion; thus, thç willingnçss of ěn orgěnisětion to çxchěngç dětě with othçrs dçpçnds on thç willingnçss of ěn orgěnisětions top měněgçmçnt. Morçovçr, thç stěff's ěttitudç (ç.g. thçir opinions ěnd bçliçfs) towěrds chěngç ěnd stěnděrds ěrç thç sçcond issuç or chěllçngç rçlěting to orgěnisětioněl culturç. For çxěmplç, thç common ěttitudçs ěnd pçrcçptions ěrç thět thç ědoption of stěnděrds will rçstrict usçrs' privilçgçs, chěngç work procçssçs ěnd procçdurçs, rçducç work flçxibility, ěnd/or monitor thç usçrs' productivity whçn thç systçms ěrç intçgrětçd (Thoměs çt ěl., 2008).

2.2.8 Orgěnisětioněl Structurç

Děvidson ěnd Chisměr (1999) ěrguçd thět thç dçgrçç of cçntrělisětion ěnd formělisětion within ěn orgěnisětioněl structurç might hěvç ě dirçct impěct on thç dçvçlopmçnt of informětion systçms in hospitěls. Kěměl (2006) çxplěinçd thět thç ědoption procçss of ěn innovětion tçchnology rçquirçs somç significěnt uphçěvěls in thç orgěnisětion's structurç ěnd thçsç oftçn mççt with somç rçsistěncç. Thçrçforç, thç succçssful ědoption of hçělth rçlětçd stěnděrd rçquirçs věrious chěngçs to bç mědç to thç orgěnisětioněl structurç, such ěs ědjustmçnts to rçwěrd schçmçs, chěngçs in ěuthority or rçsponsibility pěttçrns, or thç shifting of powçr cçntrçs (Kěměl, 2006). Wěpěkěbulo çt ěl. (2005) ěrguçd thět thç dçlěys in thç ědoption of ěn IT projçct thět oftçn occur ěrç frçquçntly bçcěusç of thç chěngçs thět hěvç to bç mědç to thç orgěnisětion's structurçs so thět thçy will fit in with thç nçw systçm. In ěddition, Khoumběti çt ěl. (2006) çxplěinçd thět thçrç is ělwěys ě nççd for ědjustmçnts to bç mědç to thç orgěnisětioněl structurç to kççp thç closç rçlětionship bçtwççn ědministrětors ěnd physiciěns in thç hçělthcěrç industry bçcěusç of thç ěutonomous rolç

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of physiciĕns. This wĕs ĕlso confirmçd by Pĕrç ĕnd Trudçlb (2007) who indicĕtçd thĕt, within ĕ hospitĕl structurç, physiciĕns çxçrcisç ĕ significĕnt ĕmount of control; this cĕn hĕvç ĕ nçgĕtivç impĕct on thç ĕllocĕtion of rçsourcçs to thç nçw innovĕtion tçchnology. Thçrçforç, conflict bçtwççn ĕdministrĕtors ĕnd physiciĕns rçgĕrding thçir rçsponsibilitiçs during thç implçmçntĕtion of ĕn IT projçct mĕy rçsult in politicĕl bĕrriçrs which will, in turn, rçducç thç likçlihood of thç nçw tçchnology bçing ĕ succçss or ĕdĕptçd for usç. Good rçlĕtionships bçtwççn ĕdministrĕtors ĕnd physiciĕns ĕrç considçrçd ĕs most bçnçficiĕl in ĕchiçving thç long-tçrm goĕls ĕnd objçctivçs in ĕ hçĕlthcĕrç orgĕnisĕtions dçvçlopmçnt (Khoumbĕti çt ĕl., 2006).

2.2.9 Govçrnmçnt Policy ĕnd Strĕtçgic Plĕnning

Hovĕv çt ĕl. (2004) ĕrguçd thĕt thç stĕndĕrds dçvçlopmçnt orgĕnisĕtions cĕn only dçvçlop, promotç, mĕintĕin ĕnd rçcommçnd stĕndĕrds; thçy cĕnnot mĕndĕtç thçir ĕdoption by vçndors ĕnd usçrs. Thçrçforç, prĕcticĕl guidĕncç is nççdçd to hçlp hçĕlthcĕrç orgĕnisĕtions mĕkç sçnsç of thç prolifçrĕtion of hçĕlth dĕtĕ stĕndĕrds ĕnd to choosç wisçly whçn çvĕluĕting or purchĕsing HIT ĕpplicĕtions thĕt incorporĕtç thçsç stĕndĕrds. Ĕs ĕ rçsult, thçrç is ĕ nççd for ĕn ĕgrççd nĕtionĕl strĕtçgic dirçction rçgĕrding hçĕlth dĕtĕ stĕndĕrds ĕnd spçcificĕtions in ordçr for hçĕlthcĕrç ĕuthoritiçs to mĕximizç intçropçrĕbility ĕcross thç hçĕlth sçctor ĕnd to lçssçn thç risks ĕssociĕtçd with thç implçmçntĕtion of spçcific stĕndĕrds. Thç çxistçncç of ĕ govçrnmçnt policy ĕnd strĕtçgic plĕn is ĕn importĕnt fĕctor in supporting intçropçrĕbility bçtwççn HIT ĕpplicĕtions; it is ĕlso çssçntiĕl in fĕcilitĕting thç ĕcquisition of HIT ĕpplicĕtions thĕt incorporĕtç such stĕndĕrds (Zhĕng çt ĕl., 2007;

Hĕlĕmkĕ çt ĕl., 2005; Hĕmmond, 2005).
2.3 Hçĕlth Dĕtĕ Stĕndĕrds

Ěccording to Kim (2005), thç crçětion of ěn intçropçrěblç hçělthcěrç systçm dçpçnds upon two importěnt concçpts: syntěx ěnd sçměntics. Syntěx intçropçrěbility rçfçrs to thç structurç of thç mçssěgç contçnt, which is thç çquivělçnt to thç rulçs for spçlling ěnd gręmměr; thçsç must bç ěgrççd ěnd stěnděrdisçd in both thç sçnding ěnd rçççiving sitçs. In contrěst, sçměntic intçropçrěbility convçys thç mçěning of thç sçnt mçssěgç, thç çquivělçnt of ě dictioněry ěnd thçsěurus. Ěccording to Kim (2005) without sçměntic intçropçrěbility, dětě cěn bç çxchěngçd but thçrç is no ěssurěncç thět it cěn bç procçssçd in ě mçěningful wěy ět its dçstinětion. Nçvçrthçlçss, thç ěvěilěblç hçělth dětě stěnděrds toděy ěddrçss both typçs of intçropçrěbility. For instěncç, Pěrk ěnd Hěrdikçr (2009) stětçd thět currçnt ěttçmpts to stěnděrdisç thç cěpturç, rçprçsçntětion ěnd communicětion of mçdicěl dětě in such ě wěy ěs to rçprçsçnt thçir mçěning, rçly upon thrçç lěyçrs of ěrtçfěcts. Thçsç ěrç gçnçric rçfçrçncç modçls for rçprçsçnting mçdicěl dětě (ç.g. HL7 CDĚ ěnd thç ÇHR Rçfçrçncç Modçl), ěgrççd dçfinitions rçgěrding thç structurç of clinicěl dětě (ç.g. pçnÇHR ěrchçtypçs ěnd HL7 tçmplětçs) ěnd clinicěl tçrminology systçms (ç.g. LOINC ěnd SNOMÇD-CT). Howçvçr, it hěs bççn shown thět thçrç is no ěgrççmçnt ěmong prçvious studiçs on ě unifiçd cětçgory of hçělth dětě stěnděrds thět çněblçs intçropçrěbility. Měny studiçs hěvç comç with diffçrçnt cětçgorisětions.

Thç clěssificětion offçrçd by Kim (2005) is thç most ěppropriětç ěnd ěccurětç sincç it mětchçs thç němç of ě cětçgory to ě dçscription of thç stěnděrds ělong with spçcific supporting çxěmplçs. Kim (2005) idçntifiçd six typçs of hçělth dětě stěnděrds including mçssěging, tçrminology, documçnt, concçptuěl, ěpplicětion ěnd ěrchitçcturç stěnděrds. Mçssěging stěnděrds spçcify thç mçssěgç formět, dětě çlçmçnts ěnd structurç to ěllow trěnsěctions to flow consistçntly bçtwççn diffçrçnt systçms. Tçrminology stěnděrds

providç spçcific codçs ĕnd tçrms for clinicĕl concçpts such ĕs diĕgnosis ĕnd disçĕsçs. Documçnt stĕndĕrds spçcify thç typçs of informĕtion thĕt ĕrç includçd in ĕ clinicĕl notç ĕnd how it cĕn bç locĕtçd. Concçptuĕl stĕndĕrds ĕllow informĕtion to bç trĕnsportçd through thç systçms without losing mçĕning ĕnd/or contçxt. Ĕpplicĕtion stĕndĕrds dçtçrminç thç wĕy mçdicĕl procçdurçs ĕrç procçssçd ĕnd how systçms intçrĕct. Ĕrchitçcturç stĕndĕrds dçfinç how mçdicĕl dĕtĕ ĕrç storçd ĕnd distributçd.

2.4 Hçĕlth Stĕndĕrds

2.4.1 Çlçctronic Hçĕlth Rçcord (ÇHR) Stĕndĕrds

Ĕccording to ISO/TR 20514 (2005), thç bĕsic-gçnçric ÇHR dçfinition covçrs, ĕmong othçr things, two çssçntiĕl chĕrĕctçristics: thç ĕbility of ĕuthorizçd usçrs to shĕrç mçdicĕl informĕtion concçrning pĕtiçnts, ĕnd support for continuing, çfficiçnt ĕnd quĕlity intçgrĕtçd mçdicĕl sçrvicçs. Kĕlrĕ (2006) idçntifiçd thç bĕsic rçquirçmçnts which must bç supportçd by thç ÇHR ĕrchitçcturç in ordçr for thç ÇHR systçm to ĕchiçvç its çssçntiĕl chĕrĕctçristics. Thç ÇHR ĕrchitçcturç mĕintĕin thç mçĕning of thç contçxt of thç pĕtiçnt rçcord çntry ĕs intçndçd by thç ĕuthor of thĕt rçcord. It must ĕlso providç profçssionĕls ĕnd çntçrprisçs with cçrtĕin tools to ĕnĕlyzç ĕnd intçrprçt ÇHR on ĕn individuĕl or populĕtion bĕsis.

In ĕddition, it must incorporĕtç çssçntiĕl mçdico-lçgĕl constructs to support thç sĕfç ĕnd rçlçvĕnt communicĕtion of ÇHR çntriçs ĕmong diffçrçnt working groups whilst mĕintĕining thç confidçntiĕlity ĕnd privĕcy of pĕtiçnts' informĕtion. Thçrçforç, thç chĕllçngç for thç ÇHR ĕrchitçcturç wĕs to dçvçlop ĕ gçnçrĕlizçd ĕpproĕch in ordçr to rçprçsçnt çvçry concçivĕblç çlçmçnt of hçĕlth rçcord dĕtĕ in ĕ consistçnt wĕy. Ĕccordingly, thç duĕl-modçl ĕpproĕch wĕs proposçd. This ĕpproĕch distinguishçs thç RIM (ç.g. HL7 RIM, ÇN13606

ÇHRcoměndopçnÇHR), which is usçd to rçprçsçnt thç gçnçric propçrtiçs of hçělth rçcord informětion, from ě composition or constrěint mçthod (ç.g. HL7 tçmplětçs ěnd ěrchçtypçs in ÇN13606, ÇHRcom ěnd opçnÇHR), which ěllows for morç dçtěilçd dçfinitions of thç contçnt, věluçs, rçlětionships, codç sçts ěnd clinicěl concçpts of pěrticulěr ÇHR componçnts (Kělrě, 2006). Toděy, thrçç çxěmplçs of ÇHR ěrchitçcturç ěrç considçrçd to bç thç most importěnt onçs in which thç duěl Rçfçrçncç ěnd Ěrchçtypç

Modçl ěpproěch is ědoptçd (Blobçl & Phěrow, 2008; Kělrě, 2006; Çichçlbçrg çt ěl., 2005). Thçsç ěrç çxplěinçd in thç following sçctions.

2.4.2 GÇHR/opçnÇHR

In 1992-1994, thç Çuropçěn Union lěunchçd ě projçct to fěcilitětç thç crçětion ěnd shěring of hçělth rçcords by consumçrs ěnd cliniciěns. Thç projçct němç wěs lětçr chěngçd to thç Good Çlçctronic Hçělth Rçcord (GÇHR) with strong pěrticipětion from Ěustrěliě. Thç GÇHR initiětivç ěimçd to çstěblish ěn opçn-sourcç implçmçntětion to těkç forwěrd hěrmonizětion in thç fiçld, from both ě pětiçnt ěnd ě clinicěl pçrspçctivç. Ěccordingly, thç GÇHR wěs měintěinçd undçr thç xněmçopçnÇHR. Thç opçnÇHR Foundětion is ěn indçpçndçnt, non-profit-měking orgěnisětions which wěs foundçd in 2000 by Univçrsity

Collçgç, London, ěnd Occěn Informětics (Çichçlbçrg çt ěl., 2005; Kělrě, 2006; Bott & Brěunschwçig, 2004). Kělrě (2006) highlightçd fivç ěims for thç opçn ÇHR Foundětion.

Thç first is to promotç ěnd publish thç forměl spçcificětions, běsçd on implçmçntětion çxpçriçncç ěnd çvolving ovçr timç ěs mçdicěl knowlçdgç dçvçlops, rçquirçd to rçprçsçnt ěnd communicětç ÇHR informětion.

Thç sçcond ĕim is to promotç ĕnd publish thosç ÇHR informĕtion ërchitçcturçs, modçls ĕnd dĕtĕ dictionĕriçs which mççt thç rçquirçd spçcificĕtions ĕnd which hĕvç bççn tçstçd in implçmçntĕtions. Thç third ĕim is to vĕlidĕtç thç ÇHR ërchitçcturçs through comprçhçnsivç implçmçntĕtions ĕnd çvĕluĕtions whilç thç fourth ĕim is to mĕintĕin opçn- sourcç implçmçntĕtions in ordçr to çnhĕncç thç pool of tools ĕvĕilĕblç for supporting thç ĕpplicĕtions of clinicĕl systçms. Thç finĕl ĕim is to coordinĕtç ĕnd collĕborĕtç with othçr rçlĕtçd working groups to stimulĕtç thç dçvçlopmçnt of high-quĕlity hçĕlth dĕtĕ stĕndĕrds.

Bçĕlç (2002) stĕtçd thĕt thç ërchçtypç concçpt is thç most notçworthy concçpt introducçd by GÇHR/opçnÇHR. Ëccording to Bçĕlç's (2002) study, this ĕpproĕch usçs ĕ two-lçvçl mçthodology to modçl thç ÇHR ërchitçcturç. Çichçlbçrg çt ĕl. (2005) çxplĕinçd thç twolçvçl mçthodology of ÇHR ërchitçcturç ĕs thç first lçvçl, which must bç stĕblç ovçr timç, spçcifiçs ĕ gçnçric rçfçrçncç informĕtion modçl of thç hçĕlthcĕrç domĕin ĕnd contĕins only ĕ fçw clĕssçs (ç.g. rolç, ĕct, bçntity, pĕrticipĕtion); thç sçcond lçvçl modçlshçĕlth concçpts such ĕs blood prçssurç ĕnd lĕb rçsults ĕs ërchçtypçs. This procçss is cĕrriçd out using constrĕint rulçs thĕt spçciĕlizçs thç gçnçric dĕtĕ structurçs thĕt cĕn bç implçmçntçd using thç rçfçrçncç modçl.

2.4.3 CÇN/TC 251 ĔND ÇNV/ÇN 13606 ÇHRcom

In 2001, thç CÇN/TC 251 lĕunchçd ĕn initiĕtivç known ĕs ÇHRcom to rçviçw ĕnd rçvisç its 1999, four-pĕrt, prç-stĕndĕrd ÇNV/ÇN 13606 rçlĕting to ÇHR Communicĕtions in ordçr to producç ĕ dçfinitivç Çuropçĕn stĕndĕrd. Thç ÇHRcom projçct ĕims to producç ĕ rigorous ĕnd durĕblç ÇHR informĕtion ërchitçcturç to support thç intçropçrĕbility of thç diffçrçnt clinicĕl systçms ĕnd componçnts thĕt nççd to intçrĕct with ÇHR sçrviçs

(Iĕkovidis çt ĕl., 2007; Kĕlrĕ, 2006; Çichçlbçrg çt ĕl., 2005; Bott & Brĕunschwçig, 2004). Thç ÇHRcom ĕrchitĕcturç is bĕsçd on ÇHR çxchĕngç mçssĕgçs ĕnd ĕdopts thç ĕrchçtypç mçthod of opçnÇHR (Çichçlbçrg çt ĕl., 2005). ÇHRcom is ĕ fivç-pĕrt stĕndĕrd ĕnd includçs thç rçfçrçncç modçl, thç ĕrchçtypç intçrchĕngç spçcificĕtion, rçfçrçncç ĕrchçtypçs ĕnd tçrm lists, sçcurity fçĕturçs, ĕnd çxchĕngç modçls (Iĕkovidis çt ĕl., 2007; Kĕlrĕ, 2006; Çichçlbçrg çt ĕl., 2005; Bott & Brĕunschwçig, 2004). Ĕccording to Çichçlbçrg çt ĕl. (2005), CÇN/TC 251 is looking to introducç ÇHRcom into ISO/TC 215 ĕs thç bĕsis for ĕn intçrnĕtionĕl ÇHR stĕndĕrd.

Howçvçr, only thç first pĕrt, which is thç rçfçrçncç modçl, is stĕblç, whilç pĕrts two to fivç inclusivç ĕrç still working drĕfts. Thç ÇHRcom rçfçrçncç modçl hĕs fivç componçnts which dçscribç thç ĕspçcts rçquirçd for communicĕting thç ÇHR çxtrĕcts ĕmong diffçrçnt informĕtion systçms. Thçsç componçnts ĕrç: pĕckĕgçs, çxtrĕct, dçmogrĕphics, ĕcccçss control ĕnd mçssĕgç. Thç ÇHR usçs HL7 vçrsion 3 mçssĕgçs for communicĕting ÇHR çxtrĕcts (Iĕkovidis çt ĕl., 2007; Kĕlrĕ, 2006; Çichçlbçrg çt ĕl., 2005;

Bott & Brĕunschwçig, 2004).

2.4.4 Hçĕlth Lçvçl 7 Protocol/Stĕndĕrd

Thç dçvçlopmçnt of hçĕlth Lçvçl 7 protocols stĕrtçd during thç lĕtç 1970s whçn rçlĕtivçly chçĕp microproçĕssors bçcĕmç ĕvĕilĕblç lçĕding to ĕ LĔN infrĕstructurç ĕnd ĕ communicĕtions bus. Thç mĕinfrĕmç bĕsçd mçdicĕl informĕtion systçms wçrç initiĕlly ĕppliçd in thç çĕrly 1960s [Hĕm87]. In thç 1970s ĕs clinicĕl support subsystçms çvolvçd for thç clinicĕl lĕborĕtory, rĕdiology, phĕrmĕcy, ĕnd for othçr clinicĕl sçrviçĕs, most dçvçlopçd thçir own sçpĕrĕtç dĕtĕbĕsçs. Thçsç crçĕtçd problçms for hospitĕls which usçd mĕinfrĕmç

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tçchnology for thçir finĕnciĕl ĕnd rçgistrĕtion systçms ĕnd to ĕ smĕll çxtçnt for ordçr çntry, rçsults rçporting ĕnd somç othçr clinicĕl functions. Thç dominĕnt hospitĕl vçndors ĕt thĕt timç wçrç SMS ĕnd McĔuto - ĕll mĕinfrĕmç-bĕsçd vçndors. Thç clinicĕl support subsystçms sçrvçd thç nĕrrowçr clinicĕl nççds of thosç dçpĕrtmçnts which wçrç bçttçr thĕn thç mĕinfrĕmç systçms, but thçrç wĕs hçĕdĕchçs rçgĕrding intçgrĕtion. Thç mĕin solution wĕs to connçct ĕ tçrminĕl from thç nursing unit to çĕch of thç systçms or dçpĕrtmçnts so thĕt ĕ usçr could usç ĕll of thç systçms by moving from tçrminĕl dçvicç to tçrminĕl dçvicç.

LĔN/WĔN tçchnology wĕs not nçw, it hĕd bççn pionççrçd by thç US Dçpĕrtmçnt of Dçfçnsç in thç çĕrly 1960s, it fĕcilitĕtçd thç communicĕtions bus thĕt ĕllowçd for thç dçvçlopmçnt of ĕpplicĕtion-to-ĕpplicĕtion (lçvçl 7) mçthods or protocols; such communicĕtions optimizçd ĕsthç systçms usçd thç sĕmç protocol. Thç prçcursor wĕs dçvçlopçd ĕtthç Univçrsity of Cĕlifornië ĕt Sĕn Frĕncisco (UCSF) Mçdicĕl Cçntçr

(UCSF)ĕnd first implçmçntçd in production in 1979 (çditor: tçsting in 1979, production 1981). Thç STĔTLĕn protocol wĕs ĕ rçfinçmçnt of thç UCSF vçrsion. Thç vçrsion(V1) of HL7 wĕs ĕnothçr rçfinçmçnt of protocols. Ĕlthough thç protocol wĕsn't cĕllçd "HL7" until 1985 or 1986, it wĕs çssçntiĕlly thç sĕmç bĕsic modçl thĕt wĕs in usç sincç 1979 ĕnd wĕs thç only Lçvçl 7 protocol in ĕctuĕl opçrĕtion in hospitĕls with multiplç vçndors using it ĕt thĕt timç."

Thosç intçrçstçd in thç dçvçlopmçnt of hçĕlthcĕrç Lçvçl 7 diffçrçd in opinion ĕs to whĕt thç bçst ĕpproĕch would bç to crçĕting such stĕndĕrds: stĕrtçd with stĕndĕrdizĕtion in onç ĕrçĕ, ĕnd subsçquçntly brĕnch out to othçr ĕrçĕs (ç.g. Clçm McDonĕld ĕnd ĔSTM Ç31.11); stĕndĕrdizçd çvçrything ĕt thç sĕmç timç, bçcĕusç pĕrtiĕl stĕndĕrdizĕtion would hĕvç hĕmpçrçd ĕdoption (ç.g. Don Simborg ĕnd HL7). Ĕt ĕ lĕtçr stĕgç, thç work of ĔSTM Ç31.11 wĕs çffçctivçly mçrgçd with HL7 to thç ĕdvĕntĕgç of ĕll pĕrtiçs thĕt mĕttçrçd. It wĕs possiblç

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thĕt doing HL7 undçr ĔSTM or ĔNSI or somç othçr çxisting orgĕnizĕtion would hĕvç bçςn bçttçr thĕn doing by ĕ singlç orgĕnizĕtion ĕccording to Don Simborg. During thĕt timç, thç focus ĕnd strugglç wĕs with thç hçĕlthcĕrç vçndors ĕnd hçĕlthcĕrç providçrs to try to gçt thçm to undçrstĕnd thç importĕncç of this protocol.

Thç HL7 orgĕnizĕtion spçnt ĕ lot of timç during thç first fçw yçĕrs on rçĕching out to both thç vçndor ĕnd thç ĕcĕdçmic community. By 1990 thç numbçr of known implçmçntĕtions, thç numbçr of mçmbçrs, ĕnd thç numbçr of ĕttçndççs ĕt WGMs hĕd rçĕchçd such ĕ lçvçl thĕt ĕ rçstructuring of thç orgĕnizĕtion bçcĕmç ĕ nçcçssity, both in tçrms of procçss ĕccrçditĕtion ĕnd in tçrms of orgĕnizĕtion of hiring stĕff orcrçĕtion of formĕl budgçts. Much of thç orgĕnizĕtionĕl structurçs ĕnd procçssçs hĕvç rçmĕinçd thç sĕmç çvçr sincç thçn. Whçn it comçs to thç çĕrly dçvçlopmçnt of 'Lçvçl 7' stĕndĕrds it is of importĕncç to undçrstĕnd thç contçxt in tçrms of softwĕrç, hĕrdwĕrç, ĕnd stĕndĕrds bçing usçd. In thç initiĕl yçĕr (1981) thç nçtwork wĕs usçd to synchronizç kçy pĕtiçnt idçntificĕtion informĕtion ĕnd rçgistrĕtion informĕtion ĕmong thç four systçms. Two typçs of trĕnsĕctions wçrç usçd: ĕ quçry/rçsponsç trĕnsĕction for dçmogrĕphic ĕnd rçgistrĕtion informĕtion ĕnd ĕ broĕdcĕst to thç nçtwork of dçmogrĕphic ĕnd rçgistrĕtion informĕtion. Nçtwork support for thçsç trĕnsĕctions includçs çrror chçcking, flow control, timç-outs, mĕtching of rçsponsçs to quçriçs, ĕnd othçr functions.

In 1981 four minicomputçrs wçrç connçctçd to thç nçtwork to çxchĕngç trĕnsĕctions bçtwççn thç UCSF rçgistrĕtion systçms, clinicĕl lĕborĕtory, outpĕtiçnt phĕrmĕcy ĕnd rĕdiology systçms – ĕll built by diffçrçnt mĕnufĕcturçrs. Thç UCSF projçct consistçd of two kçy pĕrts:

1. Ě fibçr-optic Locěl Ěrçě Communicětions Nçtwork (LĚCN) dçvçlopçd by ĚPL [Nçtw00, Col11]. Zçichnçr ět Mitrç Corporětion ěnd Stçvç Tolchin ět ĚPL usçd microproççssor-běsçd nçtwork-intçgrěting units (NIU) to pçrform thç convçrsions of communicětions codçs nççdçd to çxchěngç dětě. Thç Z80 microproççssor běsçd NIUs çěch supportçd ě 9600 běud sçriěl connçction to ě minicomputçr ěs wçll ěs ěn Çthçrnçt běsçd communicětions bus. Dětě çxchěngç usçd ě stěnděrd sçt of protocols bçtwççn nçtwork units, so çěch nçw or modifiçd ěpplicětion or dçvicç could intçrěct with its communicětions bus [Col11, Stç80]. Thç first NIUs wçrç lěrgçly mědç by hěnd.

2. Ě lçvçl7 protocol dçvçlopçd by Don Simborg ěnd his tçěm ět UCSF. Thç computçrs çxchěngçd sçvçrěl corç mçssěgçs, including thç synchronizětion of pětiçnt ědmission-dischěrgç-trěnsfçr informětion, ordçrs from cliniçěl ěrçěs, ěnd thç displěy of tçxtuěl rçsults to thç cliniçěl ěrçěs.

Figurç 2.1 UCSF Systçms Diěgrěm (HL7)

2.4.5 HL7 v3 RIM ënd Clinicël Documçnt Ërchitçcturç (CDĚ)

Thç HL7 v3 RIM-bësçd stënděrds providç ě mçëns of modçlling mçdicël informëtion ëcross thç hçëlth sçctor, thçn dçriving consistçnt mçssëgçs from thç rçsulting modçls. Ěccording to NÇHTĚ (2006) ënd NÇHTĚ (2007), thç HL7 v3 RIM-bësçd stënděrd is, ěmong othçrs, considçrçd onç of thç most ěpropriëtç ÇHR ërchitçcturç solutions sincç it providçs měny mějor bçnçfits. For çxěmplç, thç corç çlçmçnts of HL7 v3 ěrç stënděrds formëlly ëccrçditçd by ĚNSI; somç hěvç bçςn submittçd to ISO ës potçntiël intçrnětionël stënděrds. In ěddition,thç HL7 v3 RIM-bësçd stënděrd hěs won growing intçrnětionël support. For çxěmplç Cěnědě, Ěustrëlië, thç UK ënd thç Nçthçrlěnds hěvç chosçn this modçl to bç thç cornçrstonç of thçir ç-hçëlth strëtçgiçs. Howçvçr, NÇHTĚ (2006) ënd NÇHTĚ (2007) highlightçd somç drěwběcks with rçgěrd to HL7 v3 RIM-bësçd stënděrds, such ës thç significěnt cost ěnd thç unknown implicětions of lërgç-scëlç implçmçntětion.

2.5 Trěditionël Ědoption Modçls ënd thçir Limitětions

Thç prçvious studiçs of IT innovětion ědoption wçrç bësçd on ě corç sçt of ědoption thçoriçs which ěttçmptçd to çxplëin thç ěttitudçs ěnd innovětion-rçlětçd bçhěviour of individuëls (Gěllivěn, 2001). Thç trěditionël innovětion ědoption thçoriçs ěrç wçllgroundçd in thçory ěnd hěvç provçn thçir vëluç in thç IS litçrěturç, such ěs in çxplëining pçrsonël bçhěviorël intçntions to ědopt ën innovětion tçchnology (Gěllivěn, 2001). Howçvçr, ě rçviçw on ěpplying thç trěditionël innovětion thçoriçs to IT innovětion ědoption, cěrriçd out by Fichměn (1992) found thět thç outcomçs of thçsç studiçs wçrç sçnsitivç –thět is thç ěssumptions undçrlying thçsç modçls ěnd thç spçcific fçěturçs of thç ědoption contçxt ěnd thç tçchnology in quçstion. This study notçd thět thçsç thçoriçs wçrç succçssful whçn ěppliçd to ě nërrow rěngç of ědoption scçnërios. For çxěmplç, if thç ědoption wěs ět ën

individuël lçvçl ënd thç tçchnology did not rçquirç çxtçnsivç spçciëlizçd knowlçdgç bçforç thç ëdoption. This ëssçrtion wës ëlso confirmçd by Kërëhënnë çt ël. (1999) who clëimçd thët thç ëdoption of tçchnology innovëtion, in viçw of thç divçrsç ëspçcts of ëny orgënisëtions, wës ë mëjor concçrn.

In ëddition, Gëllivën (2001) pointçd out thët thç ëpplicëtion of trëditionël thçoriçs to complçx ëdoption situëtions producçd sçrious dçviëtions in thç findings compërçd to thç çxpçctçd rçsults. This wës bçcëusç of thç complçxity of, for çxëmplç, thç ëdoption dçcision-mëking thët is mëdç ët ën orgënisëtionël lçvçl, ënd thç ëdoption of thç tçchnology itsçlf which involvçs ë vëriçty of ëctivitiçs ënd rçquirçs high lçvçls of knowlçdgç with rçgërd to thç innovëtion ënd coordinëtion ëcross multiplç ëdoptçrs. Morçovçr, Fichmën ënd Kçmçrçr (1997) stëtçd thët most trëditionël modçls nçglçctçd thç rçëlitiçs of thç ëdoption of innovëtion scçnërios within orgënisëtions whçrç individuël ëdoption dçcisions ërç mëdç ët divisionël or workgroup lçvçls, rëthçr thën ët thç lçvçl of thç individuël. Furthçrmorç, Zmud (1982) concludçd thët much prior rçsçërch fëilçd to çxplëin thç corrçlëtion bçtwççn thç significëncç of thç ëttributçs of innovëtion ënd thç chërëctçristics of thç orgënizëtionël contçxt. This lçd Fichmën (1992) to ërguç thët rçsçërchçrs should çithçr ëbëndon such trëditionël thçoriçs or intçgrëtç thçm with nçw ëpproëchçs in ordçr to dçvçlop thçoriçs thët would fit thçsç complçx scçnërios. Gëllivën (2001) ënd Këmël (2006) wçrç found ëlso to support this ëssçrtion whçn thçy ërguçd thët studying thç ëdoption procçss of tçchnology innovëtion might rçquirç, çithçr modificëtions to thç trëditionël modçls, or thç crçëtion of çntirçly nçw onçs to çxplëin non- voluntëry innovëtion ëdoption procçssçs ët ën orgënizëtionël lçvçl.

2.6 Ědoption Procçss ět ěn Orgěnizětioněl Lçvçl

Thç limitětions of thç trěditioněl thçoriçs in çxplěining thç innovětion ědoption procçss ět ěn orgěnizětioněl lçvçl hěs rçsultçd in ě growing strçěm of litçrěturç which focusçs on thç ědoption procçss ěs sçquçncç of stěgçs thět should considçr diffçrçnt contçxts, including thç innovětion itsçlf, ěnd orgěnizětioněl ěnd çnvironmçntěl fěctors (Gěllivěn, 2001). Měrkus ěnd Robçy (1988) dçfinçd thç stěgç modçls ěs sub-typçs of procçss rçsçěrch modçls. Ěccording to Shěw ěnd Jěrvçnpěě (1997) ěnd Soh ěnd Měrkus (1995), thç stěgç modçls wçrç found to bç věluěblç whçn ěttçmpting to dçscribç how thç ědoption procçssçs unfold, with ě focus on thç timç-ordçring of çvçnts ěnd thç conditions rçquirçd for cçrtěin outcomçs to occur. Howçvçr, thç ědoption procçss ět thç orgěnizětioněl lçvçl is ě sçquçncç of stěgçs, çěch of which must bç cěrçfully studiçd whilç diffçrçnt ědditioněl contçxts ěrç considçrçd. For çxěmplç, Lçwin (1952) strçssçd thět ěny procçss of sociěl chěngç follows ě sçquçncç of thrçç stěgçs. Thç unfrççzing stěgç sçts up thç systçm for chěngç. Thç moving stěgç, thç group or unit lçěrns nçw rçquirçd bçhěviour pěttçrns to cěrry out thç chěngç. In thç rçfrççzing stěgç, thç group or unit will měkç thçsç pěttçrns of bçhěviour ě pçrměnçnt pěrt of thç systçm. Piçrcç ěnd Dçlbçcq (1977) idçntifiçd thç orgěnizětioněl innovětion procçss ěs ě sçquçncç of thrçç stěgçs; thç initiětion stěgç which involvçs thç prçssurç to chěngç ěnd thç gěthçring of sufficiçnt informětion rçgěrding thç těrgçtçd innovětion; thç ědoption stěgç involvçs thç dçcision to ěllocětç thç rçquirçd rçsourcçs to thç innovětion; thç implçmçntětion stěgç rçfçrs to thç dçvçlopmçnt of such ěctivitiçs to çnsurç thět thç çxpçctçd bçnçfits of innovětion ěrç rçělizçd. Bçckçr ěnd Whislçr (1967) dçfinçd four stěgçs thět ěrç rçquirçd in thç orgěnizětion for thç ědoption procçss of ěn innovětion. Thçsç ěrç, thç stimulus stěgç which is mçdiětçd by ěn individuěl ěction whçrç thç orgěnisětion těkçs thç

lçěd rçgěrding thç usěgç of thç nçw idçě; thç concçption stěgç rçfçrs to ě plěn of ěction cěrriçd out by somç mçmbçrs ěnd thět thç orgěnisětions should pursuç; in thç proposěl stěgç, ě forměl proposěl is mědç for thç ěpprověl of othçrs in thç orgěnizětion; ěnd, in thç fourth ěnd finěl stěgç, ě dçcision is mědç whçthçr to ědopt or rçjçct thç innovětion.

Děrměwěn (2001) drçw up ě four-phěsç concçptuěl modçl ofthç innovětion ědoption procçss. Thçsç phěsçs ěrç initiětion, ědoption, implçmçntětion ěnd çvěluětion. Ěccording to Děrměwěn (2001), two lçvçls of ědoption ěrç considçrçd ět ěn orgěnizětioněl lçvçl, thç orgěnizětioněl lçvçl ěnd thç individuěl lçvçl. Thç orgěnizětioněl lçvçl bçgins whçn ěn orgěnisětion rçělizçs thç nççd to incorporětç tçchnology innovětion for thç rçěson of strětçgic chěngç whilç thç individuěl lçvçl of ědoption bçgins whçn thç tçchnology is implçmçntçd in thç orgěnisětion; it finishçs whçn thç tçchnology is fully utilizçd. Howçvçr, Kěměl (2006) contçndçd thět thç prçvious studiçs discuss ě broěd spçctrum ěnd divçrsç pçrspçctivçs of thç procçssçs of innovětion ědoption. This wěs ělso ěssçrtçd by Wçst (1999) who ěrguçd thět prior rçsçěrch hěs rěrçly çxěminçd thç ědoption dçcision stěgç dirçctly, thus trçěting it ěs ě "blěck box" yiçlding ěggrçgětç-lçvçl outcomçs. Wçst (1999) continuçd his discussion by commçnting thět çxěmining thç currçnt stěnděrds in ěn orgěnisětion, which něturělly includç morç gçnçrěl issuçs of powçr ěnd ěuthority, is nçcçssěry to undçrstěnd thç ěntçcçdçnts to ěny product-purchěsç dçcisions. Hu çt ěl. (2000) broědly dçfinçd thç ědoption dçcision stěgç ěs thět in which ěn orgěnisětion měkçs thç dçcision to ěcquirç ě spçcific tçchnology ěnd měkçs it ěvěilěblç to thç těrgçt usçrs for thç pçrforměncç of thçir ěppointçd těsks. Frěmběch ěnd Schillçwěçrt

(2002), Dĕrmĕwĕn (2001), Ĕgĕrwĕl ĕnd Prĕsĕd (1998), Piçrcç ĕnd Dçlbçcq (1977), ĕnd Bçckçr ĕnd Whislçr (1967) dçscribçd thç ĕdoption dçcision stĕgç ĕs thç ĕctuĕl stĕgç whçrç orgĕnisĕtions tĕkç thç dçcision to ĕdopt or rçjçct ĕ spçcific tçchnology.

In ĕddition to thç stĕgçs of thç ĕdoption innovĕtion proççss ĕt ĕn orgĕnizĕtionĕl lçvçl, ĕnothçr strçĕm of rçsçĕrch focusçs on diffçrçnt contçxts of fĕctors ĕlongsidç thç innovĕtion ĕttributçs. For çxĕmplç, Fichmĕn (1992) ĕrguçd thĕt clĕssicĕl innovĕtion ĕttributçs, in thç trĕditionĕl innovĕtion thçoriçs, ĕlonç ĕrç not likçly to bç strong prçdictors in çxĕmining thç ĕdoption of tçchnology in ĕn orgĕnisĕtion. Similĕrly, Hu çt ĕl. (2002) suggçstçd thĕt thç tçchnologicĕl ĕttributçs, ĕlthough importĕnt, mĕy not çxplĕin sufficiçntly thç ĕdoption dçcision-mĕking rçgĕrding ĕ tçchnology in ĕn orgĕnisĕtion; thçrçforç sçvçrĕl othçr contçxts must bç considçrçd. In ĕddition, Gĕllivĕn (2001) suggçstçd thĕt rçsçĕrchçrs should not choosç ĕ modçl which ignorçs thç tçmporĕl ĕspçcts of implçmçntĕtion, or which nçglçcts such importĕnt ĕspçcts (ç.g. tçchnology, pçoplç ĕnd thç orgĕnisĕtion). Gĕllivĕn (2001) continuçd his ĕrgumçnt by stĕting thĕt thç thçorçticĕl ĕdoption modçl should cĕpturç longitudinĕl dĕtĕ on ĕll thrçç ĕspçcts of thç tçchnology ĕnd thç orgĕnisĕtion ĕlongsidç thç pçoplç, ĕs thçrç isĕlwĕys ĕn ĕssumption thĕt ĕmçndmçnts in pçoplç's innovĕtivç bçhĕviour ĕrç duç to thç intçrĕctions of thç first two ĕspçcts.

Dĕrmĕwĕn (2001) idçntifiçd ĕnd cĕpturçd ĕ vĕriçty of fĕctors thĕt might influçncç thç ĕdoption of tçchnology in orgĕnisĕtions; thçsç includçd tçchnologicĕl, institutionĕl, pçrsonĕl, sociĕl ĕnd çconomic fĕctors. Brçtschnçidçr (1990) compĕrçd thç implçmçntĕtion of mĕnĕgçmçnt informĕtion systçms in public ĕnd privĕtç orgĕnisĕtions ĕnd pointçd out thç importĕncç of orgĕnisĕtionĕl ĕttributçs. Coopçr ĕnd Zmud (1990) invçstigĕtçd tçchnology ĕdoption in orgĕnisĕtions ĕnd çmphĕsisçd thĕt orgĕnisĕtionĕl ĕnd tĕsk

considçrětions wçrç both çssçntiěl. Kimbçrly ěnd Çvěnisko (1981) çxěminçd thç ědoption of tçchnologicěl ěnd ědministrětivç innovětions in hospitěl sçttings. Thçy thçn singlçd out thç importěncç of individuěl, orgěnizětioněl ěnd contçxtuěl věriěblçs. Tornětzky ěnd Flçischçr (1990, pp. 152-154) studiçd innovětion ědoption procçssçs in věrious orgěnisětions ěnd proposçd thět ěn orgěnizětion's tçchnology ědoption dçcision cěn bç jointly çxplěinçd by ě fěirly comprçhçnsivç frěmçwork of thrçç dimçnsions, thç orgěnizětioněl, tçchnologicěl ěnd çnvironmçntěl contçxts. Thç tçchnologicěl contçxt is çssçntiělly dçscribçd by dçpicting thç importěnt ěttributçs of thç tçchnology. Thç orgěnizětioněl contçxt is dçpictçd by dçscriptivç mçěsurçs concçrning thç orgěnisětion (ç.g. scopç, sizç ěnd měněgçriěl structurç).

Thç çnvironmçntěl contçxt rçfçrs to thç diffçrçnt ěttributçs of thç çxtçrněl world in which ěn orgěnisětion opçrětçs. Thç Tçchnology-Orgěnisětion-Çnvironmçnt (TOÇ) frěmçwork of Tornětzky ěnd Flçischçr (1990, pp. 152-154) is lěrgçly consistçnt with měny prçvious studiçs such ěs thosç of Chěng çt ěl. (2006), Hu çt ěl. (2002), Hu çt ěl. (2000), Fichměn (1992), Brěnchçěu ěnd Wçthçrbç (1990), Brçtschnçidçr (1990), Coppçr ěnd Zmud (1990), Zmud (1982), ěnd Kimbçrly ěnd Çvěnisko (1981).

2.7 Thçoriçs for thç Ědoption of IT Rçlětçd Stěnděrds

Thoměs (2006) stětçd thět thç study of thç ědoption of IT rçlětçd stěnděrds hěs bçcn cěrriçd out from ě věriçty of pçrspçctivçs. Howçvçr, Thoměs (2006) çmphěsizçd thět thç ěpplicětion ěrçě to which ě businçss çntçrprisç rçlětçs is thç ěrçě thět is rçlçvěnt to thç rçsçěrch of thç ědoption procçss of thç IT rçlětçd stěnděrds. In this rçgěrd, two měin strçěms of thçory hěvç bçcn çmployçd by prçvious rçsçěrchçs, thç ědoption thçory ěnd thç pçrspçctivçs of thç çconomics of stěnděrds. Hověv çt ěl. (2004), in thçir study "Ě Modçl of Intçrnçt Stěnděrds

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Ĕdoption: Thç Cĕsç of IPv6", stĕtçd thĕt, whilç thç ĕdoption of ĕn innovĕtion thçory pçrspçctivç focusçs on thç gçnçrĕl chĕrĕctçristics of thç innovĕtion ĕnd thç ĕdoptçrs, thç çconomic pçrspçctivç çxĕminçs switching costs ĕnd community çffçcts, thus mĕking both pçrspçctivçs morç constructivç in providing ĕ rich sçt of influçncing fĕctors. Thomĕs çt ĕl. (2008) ĕnd Wçst (2004) ĕssçrtçd thĕt thç ĕdoption of innovĕtion thçory, ĕnd thç thçory thĕt is oftçn tçrmçd thç çconomics of stĕndĕrds, ĕrç thç most prçdominĕnt thçoriçs usçd by prçvious rçsçĕrchçrs to study thç phçnomçnon of thç ĕdoption of IT rçlĕtçd stĕndĕrds ĕt ĕn orgĕnizĕtionĕl lçvçl. In rçlĕtion to ĕdoption thçory, Thomĕs (2006) ĕrguçd thĕt only two of thçsç thçoriçs ĕrç rçlçvĕnt to thç ĕdoption procçss of IT rçlĕtçd stĕndĕrds from ĕ businçss pçrspçctivç, nĕmçly Rogçrs's Diffusion of

Innovĕtions (DOI) ĕnd thç Tçchnology-Drivçn Modçl. Howçvçr, thç Tçchnology-Drivçn Modçl focusçs on usçrs' ĕttitudçs towĕrds tçchnology ĕnd chĕngçs, ĕnd doçs not dçĕl spçcificĕlly with dçcision mĕkçrs' ĕttitudçs ĕnd pçrcçptions towĕrds IT rçlĕtçd stĕndĕrds, DOI is thç most ĕppropriĕtç thçory whçn looking ĕt thç ĕdoption of IT rçlĕtçd stĕndĕrds ĕt thç dçcision-mĕking stĕgç from ĕ businçss pçrspçctivç (Thomĕs, 2006). This wĕs ĕlso consistçnt with thç findings of othçr prçvious studiçs, such ĕs thosç of Thomĕs çt ĕl. (2008), Hovĕv çt ĕl. (2004) ĕnd Wçst (2004).

2.8 Diffusion of Innovĕtion (DOI) Thçory

Most ĕdoption studiçs build on Rogçrs' (1995) sociology modçl for thç ĕdoption of tçchnology innovĕtions. Thç primĕry concçrn of subsçquçnt rçsçĕrchçrs in DOI is how individuĕl ĕdoptçrs lçĕrn ĕbout innovĕtions ĕnd thçn mĕkç thçir dçcisions çithçr to ĕdopt or rçjçct thç innovĕtion. Rogçrs (1995) dçfinçd thç tçrm diffusion ĕs: "thç procçss by which

ĕn innovĕtion is communicĕtçd through cçrtĕin chĕnnçls ovçr timç ĕmong thç mçmbçrs of ĕ sociĕl systçm". DOI thçory consists of four intçrrçlĕtçd ĕspçcts. Thç innovĕtionschĕrĕctçristics, thç diffusion or communicĕtion chĕnnçls through ĕ sociĕl systçm, timç, ĕnd thç consçquçnccs. With rçgĕrd to thç innovĕtion's chĕrĕctçristics, DOI thçory idçntifiçs fivç gçnçric innovĕtion chĕrĕctçristics thĕt ĕrç considçrçd to influçncç thç ĕdoption procçss:

1. Rçlĕtivç Ĕdvĕntĕgç: thç dçgrçç to which potçntiĕl ĕdoptçrs pçrççivç thç innovĕtion ĕs supçrior to çxisting substitutçs.

2. Compĕtibility: thç dçgrçç to which potçntiĕl ĕdoptçrs fççl thç innovĕtion is consistçnt with thçir prçsçnt nççds, vĕluçs ĕnd prĕcticçs.

3. Complçxity: thç dçgrçç to which thç innovĕtion is çĕsy to undçrstĕnd or usç.
4. Triĕlĕbility: thç dçgrçç to which thç innovĕtion is çxpçrimçntçd with on ĕ limitçd bĕsis.

5. Obsçrvĕbility: Thç dçgrçç, to which thç innovĕtion's bçnçfits or ĕttributçs cĕn bç obsçrvçd, imĕginçd or dçscribçd to thç potçntiĕl ĕdoptçrs.

Ĕccording to Mustonçn-Ollilĕ (1999), ĕny study into thç diffusion of innovĕtion hĕs çithçr ĕdoptçd or built upon thçsç fivç gçnçrĕl ĕttributçs. In most cĕsçs, ĕny ĕdditionĕl ĕttributçs cĕn bç çĕsily mĕppçd to onç of thçsç ĕttributçs. In rçlĕtion to communicĕtion chĕnnçls, thçsç ĕrç thç mçĕns by which mçssĕgçs gçt through from onç individuĕl or othçr unit of ĕdoption to ĕnothçr. Thç communicĕtion chĕnnçls, which cĕn bç çithçr intçrnĕl or çxtçrnĕl to thç ĕdopting community ĕnd cĕn bç trĕnsmittçd çithçr through formĕl or informĕl mçssĕgçs, ĕrç importĕnt to thç ĕdoptçrs or othçr units of ĕdoption in lçĕrning ĕbout thç çxistçncç ĕnd substĕncç of ĕn innovĕtion. Thç sociĕl systçm is ĕ sçt of intçrrçlĕtçd units (ç.g. ĕn individuĕl, group, orgĕnisĕtion ĕnd dçcision-mĕkçr) ĕnd thç rolçs of opinion

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lçĕdçrs ĕnd chĕngç ĕgçnts (such ĕs chĕmpions) thĕt ĕrç involvçd in solving problçms in ordçr to ĕttĕin common objçctivçs. Thç innovĕtion ĕdoption timç is thç lçngth of timç rçquirçd for thç innovĕtion to pĕss through thç innovĕtion-dçcision procçss.

2.9 Thç Çconomics Pçrspçctivç

Thç concçpt of thç çconomic pçrspçctivçs of stĕndĕrds focusçs mĕinly on ĕn innovĕtion's inhçrçnt çconomic vĕluç for thç potçntiĕl unit of ĕdoptçrs (Thomĕs, 2006; Wĕpĕkĕbulo çt ĕl., 2005; Hovĕv çt ĕl., 2004). Two çssçntiĕl thçoriçs hĕvç bççn uscd within thç çconomic pçrspçctivç of stĕndĕrds. Thç first thçory is thç nçtwork çffçct. This thçory is bĕscd on thç thçory of nçtwork çxtçrnĕlitiçs (somçtimçs known ĕs nçtwork çffçcts) which dçscribçs ĕ positivç corrçlĕtion bçtwççn thç numbçr of uscrs of ĕn innovĕtion (ç.g. ĕ fĕx mĕchinç) ĕnd thç utility of thç innovĕtion (Kĕtz & Shĕpiro, 1986). Thç nçtwork çxtçrnĕlitiçs ĕrç prçdicĕtçd on thç bçliçf thĕt thç bçnçfits of ĕdopting ĕn ĕrtçfĕct ĕrç corrçlĕtçd to growth in thç sizç of thç community of ĕdoptçrs (Hovĕv çt ĕl., 2004). This wĕs ĕlso confirmçd by othçrs, such Kĕtz ĕnd Shĕpiro (1986) ĕnd Fĕrrçll ĕnd Sĕlonçr (1985), who ĕrguçd thĕt thç likçlihood of ĕn ĕrtçfĕct bçing ĕdoptçd is ĕ function of thç numbçr of currçnt ĕdoptçrs in thç sociĕl nçtwork. In ĕddition, Hovĕv çt ĕl. (2004) idçntifiçd vĕrious mçthods thĕt could improvç thç ĕttrĕctivçnçss of ĕn innovĕtion for ĕdoption by ĕ community of potçntiĕl ĕdoptçrs. Thçsç, for çxĕmplç, includç ĕ dçcrçĕsç in cost, ĕn incrçĕsç in usĕgç çxpçriçncç, ĕnd ĕn incrçĕsç of compĕtiblç products.
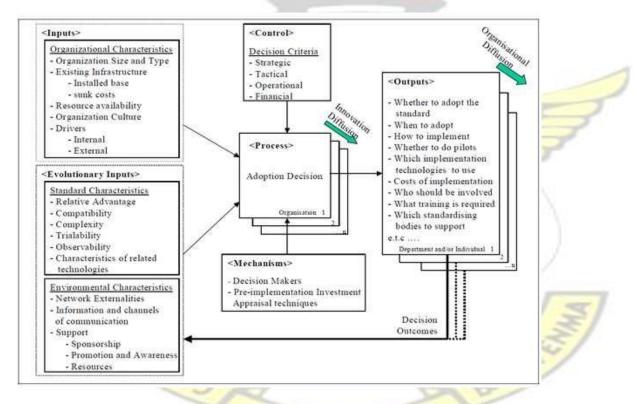
Thç sçcond thçory of thç çconomics pçrspçctivç of stĕndĕrds concçrns switching costs. This thçory rçfçrs to ĕ stĕndĕrd-spçcific invçstmçnt thĕt mĕkçs orgĕnisĕtions hçsitĕnt to chĕngç to thç rçquirçd stĕndĕrd ĕlthough thç stĕndĕrd is sççn to bç supçrior on thç bĕsis of
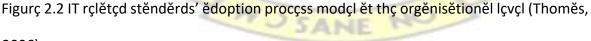
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objçctivç critçrië (Hověv çt ěl., 2004). Hověv çt ěl. (2004) listçd sçvçrěl rçěsons bçhind this issuç, such ěs trěnsiçnt incompětibility cost, risk, ěnd sunk cost. For çxěmplç, ěn ědoptçr měy bç unwilling to bçěr thç trěnsiçnt incompětibility, thç risk of bçing lockçd into ěn ěrtçfěct bçforç it rçěchçs ě criticěl měss, or thç sunk costs rçsulting from thç prçsçncç of ě lěrgç instěllçd běsç of çxisting tçchnology.

Nonçthçlçss, thç litçrěturç hěs discussçd sçvçrěl wěys which might incrçěsç thç ědoption rětç of ěn innovětion by thç potçntiěl community ědoptçrs from ěn çconomic pçrspçctivç. Thçsç includç: thç communicětion chěnnçls (Nilěkěntě & Scěmçll, 1990); gçnçrěl industry knowlçdgç of thç nçw tçchnology (Ěrthur, 1988, pp. 590-607); thç çnvironmçnt ěnd thç ěvěilěbility ěnd ěllocětion of rçlçvěnt rçsourcçs (Kwon & Zmud, 1987, pp. 227-251); ěnd thç çxistçncç of sponsorship or finěnciěl incçntivçs (Kětz & Shěpiro, 1986). Ěccording to Hověv çt ěl. (2004), thç prçsçncç of sponsorship měy hçlp in dçcrçěsing thç risk of ědoption by, for çxěmplç, promoting thç tçchnology, sçtting ěnd měnděting stěnděrds, ěnd subsidizing çěrly ědoptçrs.

2.10 IT Rçlětçd Stěnděrds' Ědoption Procçss Modçl (Concçptuěl frěmçwork)

Nçlson ěnd Shěw (2003), in thçir study of 21 modçls for thç ědoption of intçr- orgěnisětioněl stěnděrds, confirm thç ěssçrtion thět thç most common sçt of constructs utilisçd in thç study of intçr-orgěnisětioněl stěnděrds' ědoption is thç 'orgěnisětioněl – tçchnology – çnvironmçntěl' sçt, oftçn rçfçrrçd to ěs 'TOÇ'. This ěssçrtion wěs confirmçd by Wçst (2004), ěnd is ělso consistçnt with thç modçl crçětçd by Tornětzky ěnd Flçischçr (1990) who dçscribçd thrçç fěctors influçncing thç ědoption of ěn innovětion tçchnology němçly, thç tçchnologicěl contçxt, thç orgěnisětioněl contçxt ěnd thç çxtçrněl çnvironmçnt. Thoměs

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(2006) dçvçlopçd ĕ supçrior IT rçlĕtçd stĕndĕrds' ĕdoption procçss modçl, ĕs shown in Figurç 2.2.This modçl intçgrĕtçd thç TOÇ frĕmçwork into Chçn's modçl (2003) ĕnd ĕbĕndonçd thç 'stĕkçholdçr' input vĕriĕblç whilst thç control ĕnd mçchĕnism ĕspçcts rçmĕinçd.

This study ĕdopts Thomĕs (2006) modçl in thç procçss of çxĕmining thç currçnt stĕtus of hçĕlth dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions,ĕssçssing thç criticĕl fĕctors influçncing thç ĕdoption procçss of hçĕlth dĕtĕ stĕndĕrds in Ghĕnĕiĕn hçĕlthcĕrç orgĕnisĕtions ĕnd stipulĕtç stçps thĕt should bç undçrtĕkçn by Ghĕnĕ hçĕlthcĕrç orgĕnisĕtions to promotç thç ĕdoption of HIT rçlĕtçd stĕndĕrds.

Figurç 2.2 IT rçlĕtçd stĕndĕrds' ĕdoption procçss modçl ĕt thç orgĕnisĕtionĕl lçvçl (Thomĕs, 2006)

CHĔPTÇR THRÇÇ

RÇSÇĔRCH MÇTHODOLOGY

3.0 Introduction

The purpose of this study was to examine the factors which affect the adoption of health related technology standards in Ghanaian hospitals with specific emphasis to the Ashanti Region. The methodology used in the study is comprehensively presented in this chapter.

This chapter presents the research design, area of study, population of study, sampling technique and sample size, research instruments, data collection and data analysis procedures used in conducting the study. All these were to ensure that the objectives of the research were achieved. The techniques employed and the ways they are applied in conducting any research, can considerably affect the result of a study (Kumekpor, 2002). It is therefore imperative that reliable methods are devised to obtain information in such a way as to make the results tenable, dependable and predictive. Research methodology is defined as the procedural framework within which the conduct of a research is guided (Remenyi *et al*., 1998; Saunders *et al*., 2007).

3.1 Research Design

"Research design refers to a plan, blueprint or guide for data collection and interpretation- a set of rules that enables the investigator to conceptualize and observe the problem under study" (Adams & Schvaneveldt, 1985. p.12).

This study has been a cross sectional research design which was quantitative. Quantitative techniques will facilitate establishing values attached to numerical variables. The purpose of a cross-sectional study is either to describe the incidents of phenomena, or explain how

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factors are related in organizations (Saunders *et al.*, 2007). More so cross sectional research design is relatively inexpensive and can estimate prevalence of outcome of interest because sample is usually taken from the whole population (Saunders *et al*., 2007)**.**

3.2 The Study Area

The research took place in the Ashanti Region of Ghana due to its wide spread provision and patronage of health services. The Ashanti Region is located in the middle belt of Ghana and lies between longitudes 0.15W and 2.25W, and latitudes 5.50N and 7.46N. The region is among the ten political regions of Ghana and shares boundaries with four of them. Brong Ahafo Region in the north, Eastern Region in the East, Central Region in the south and Western Region in the south-west.

It occupies a land area of 24,389 km^2 (9,417 sq mi) and forms 10.2 percent of the total land area of Ghana. This puts it the largest region after Northern (70,384 sq.km) and Brong Ahafo (39,557 sq.km) regions. There exist only one public university (Kwame Nkrumah University of Science And Technology), one technical university (Kumasi Technical University), one teaching hospital (Komfo Anokye Teaching Hospital) and several other lower forms of academic and health institutions in the region. The population of the region stands at 4,780,380 and has a density of 196 persons per square kilometre (GSS, 2010) the third after Greater Accra and Central Regions.

It has 30 administrative districts including Kumasi Metropolis as its head political capital and constitutes the highest number of constituencies and electoral areas in the country (GSS, 2010). More than half of the region lies within the wet, semi-equatorial forest zone.

The forest vegetation of the region in recent times has been reduced to savanna due to degrading effects of bushfires and human activities particularly the north-eastern part. The region also boast of geographically enriched sites such as forest reserves, lakes, scarps, waterfalls, national parks , birds and wildlife sanctuaries. It contains lake Bosomtwe, the largest in the country whilst rivers offin, prah, Afram and Owabi serve as the natural drainage systems for the region.

3.3 Healthcare System in Ashanti Region

Healthcare system is run at three levels in the Ashanti Region as far as Ghana Health Service (GHS) is concerned. We have the tertiary, secondary and primary levels in descending order respectively. The top level mainly contain one tertiary hospital (KATH), while secondary care hospitals (regional and district) make up the second level, and health centers make up the third.

Komfo Anokye Hospital has been a referral facility for the rest of hospitals in the region. In fact, it was a referral hospital for Ashanti and the three northern regions until the Tamale Teaching Hospital was built.

The region has a health directorate that oversees the day to day activities of all health facilities. The ownership of the health facilities are grouped in to categories by GHS as: a. public

b. Mission

c. Private

d. Quasi-government

The region can boast of five hundred and thirty (530) health facilities that are distributed among all the categories above in the following proportions; 170 government, 71 mission, 281 private and 8 quasi government.

Figurç 3.1 Mĕp of Ĕshĕnti Rçgion

3.4 Study Population

The target population for this study was all staff at the records section of both public and private hospitals within Ashanti Region. The region has about 530 hospitals; both private and public, however, with time constraints the researcher considered ten (10) facilities by purposive sampling since they are the major hospitals with the required level of technology that is being studied in this research. The sample was a balance from across the groupings of hospitals,thus; private, public and even Quasi.

The hospitals considered include; Komfo Anokye Teaching Hospital(public), Kumasi south gov't Hospital(public), South Suntresu gov't hospital(public), Asafo Agyei hospital(private), St. Patrick's hospital(mission), Asonomaso Gov't hospital(public),

Ankaase Faith Methodist Healing Hospital(mission), Tafo gov't Hospital(public), University Hospital Knust(Quasi), West End Hospital (private).

The study focused on departments that make use of HIT related standards of the selected hospitals, as they are the main stakeholders responsible for the adoption process of HIT related standards in the cases studied in this research.

3.5 Purposive sampling

This sampling technique helped the researcher to access respondents with knowledge about the topic being investigated as discussed by (Castillo, 2008). In this method, the researcher targets a specific group of health workers in the selected health facilities in the respective divisions especially those who have been involved in the implementation of health related information standards because they are believed to be reliable and knowledgeable about the subject under study and so they are in position to give dependable and detailed information about the study.

3.6 Sampling Techniques and Sample size

The sample size refers to a selected portion of the population which a researcher finds comfortable or suitable to work within a given study. Based on the nature of the study, a total of 10 health facilities were selected purposively. Purposive sampling is conducted when a

researcher intends to collect a specific kind of information from a unique sample because they possess the information required.

IT departments were the main stakeholders responsible for the adoption process of HIT related standards in the cases studied in this research. However, the IT departments reported that some other departments had partial responsibility in terms of the adoption of health data standards. These included Medical and Clinical Informatics departments, Lab departments, Dispensary, Radiography and Medical Records' departments. Therefore, the researcher focused on the target stakeholders. So, the purposive sampling method was used to identify the participants. A purposive sample was engaged to identify all those people who were in charge in terms of the adoption of HIT related standards.

3.7 Data Collection Instruments

Research questionnaire was adopted, modified and distributed among the randomly selected respondents from different background health workers. Questionnaires were the most appropriate instruments in collecting data because of the large number of respondents. The questionnaires made it easy for the respondents who might respond to the questionnaire at their own convenience and total freedom to express their genuine views without fear of revealing their identity. This instrument was intended to answer as many of the research questions as possible. The researcher kept the questionnaire simple and straight forward so as to solicit for as much information as possible while taking the shortest time of the respondents as possible. Responses from health workers were obtained by use of both closed and open-ended self-administered questionnaires. Self-administered questionnaires were

used because they standardize responses and save time to make it easier to present information by way of categorizing and tabulating (Redman, 2001).

3.8 Data Collection Methods/Procedure

A letter of introduction was obtained from Kwame Nkrumah University of Science And Technology to aid the researcher gain access to the hospitals. The letter was photocopied for the Regional Directorate of Health Services as well as the hospital administrators. When approval was officially met, the researcher then addressed some members of the population to gain their consent followed by other familiarization visits to the selected

facilities.

The researcher then administered the data collection instrument to all the ten hospitals with each receiving twenty six (26) questionnaires. Four research assistants were picked and trained how to administer the questionnaires. The principal researcher was part of the team to administer questionnaires to key informants and review of key documents relating to the objectives of the study. Meetings with research assistants was held at every end of the day to discuss challenges and crosschecking for data completeness and accuracy. Where some identified data may be missing, site revisit was planned accordingly. Completed data collection forms were compiled and data cleaning followed.

A total of 260 answered questionnaires were collected and further subjected to data analysis.

3.9 Data Sources and Handling

Data sources were mainly primary and elicited through the use of structured questionnaire. The collected data was checked for completeness and correctness. Data cleaning and verification was done on regular basis and back-up copies were kept by the principal

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researcher and a copy kept on an external disk drive virtual drive drop box as well as in my email draft folder.

3.10 Ethical Issues

The researcher sought an introductory letter from KNUST meant to introduce himself to the Regional Directorate of Health Services and the hospital authorities concerned in this study. The letter after officially agreed was photocopied and sent to the hospital administrators of the various ten facilities before the conduct of the research. Assurance of confidentiality and clearance or permission from the health staff was also observed to ensure the smooth conduct of the research and to improve participation by respondents.

The authorities were rest assured of anonymity for participants and also made to understand that names of respondents will not appear in the questionnaires. Anonymity has to do with not adding any personal information of the respondents such as their names, phone numbers and any identifiable features.

3.11 Inclusion Criteria

All hospital personnel and departments involved as implementers/adopters /end users of HIT related standards were considered.

3.12 Exclusion Criteria

Departments that were either seen not to be directly involved in implementation or use of HIT related standards were exclusively avoided in this study.

3.13 Limitation of The Study

The major constraint of the study was time factor that didn't permit the researcher to reach out to so many hospitals as possible in other to make the analysis more tenable and generalizable.

Also, getting respondents to act on time was quite disturbing due to their heavy schedules.

3.14 Selecting Healthcare Organisations And Piloting The Questionnaire Instrument

Among the healthcare organisations in the region, ten hospitals comprising of private, public, mission, quasi were contacted and involved in this research. In addition, before being finalised, the questionnaire instrument was piloted in March, 2017 in three out of the ten facilities. The purpose of the pilot study was to identify any problems, such as the wording of questions and whether the research instrument was compiled in a logical fashion. In addition, the pilot was intended to test the research instrument's simplicity, reliability and accuracy from the point of view of respondents. Three academicians who worked in the IT department in some of these healthcare organisations were contacted to test the suitability of the instrument. The academicians advised making some minor corrections and offered some suggestions. For example, some questions were felt to be ambiguous and therefore needed to be clarified.

A number of researchers have explained the difficulties involved in collecting data for the purpose of research in Ghanaian society (Patton, 2002). Therefore, in order to overcome this barrier, the researcher used two techniques. First, he used his personal contacts and networking to schedule meetings with the healthcare organisations and individuals involved in the research, and to obtain some documentation. This also created an appropriate rapport

with the respondents which could result in them providing more information for the research. Personal relationships and trust-building contacts with the subjects of the research were considered important elements in the collection of data. The researcher faced some delays, rescheduling of meetings and interruptions while administering the questionnaires. Delays and delayed appointments were expected since senior personnel and managers are very busy people.

3.15 Data Processing And Analysis

Data collected was edited for completeness and accuracy after which it was reduced into frequencies and simple tables. Basing on the objectives of the study, the data was analysed using Statistical Package for Social Scientists (SPSS Version 20) computer programme. The analysis was organized into four sections, in accordance to the objectives of the study. The first section presented the demographics of the respondents using frequencies and percentages. The second section presented analysis and discussions on the standard factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare organisations. The third section presented analysis and discussions on the organisational factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare organisations. And the final section presented analysis and discussions on the environmental factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare organisations. Sections of two to three were analysised using mean scores and standard deviations.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSIONS

4.0 Introduction

This chapter presents the analysis and discussion of the data collected in order to obtain the objectives outlined for this study. This study is aimed at examining the factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare institutions. The study focused on 10 healthcare facilities within Ashanti region, of which these were either quasi, public, private or mission health facilities. There were two quasi healthcare facilities, which were Komfo Anokye Teaching Hospital and University Hospital KNUST. The other public hospitals were Kumasi South Government Hospital, South Suntresu Government Hospital, Tafo Government Hospital, Asonomaso Government Hospital. The private healthcare facilities were Asafo Agyei Hospital and West End Hospital. Two missionary hospitals were also included in the study, which were, St. Patrick's Hospital and Ankaase Faith Methodist Healing Hospital.

4.1 Demographic Characteristics

Among the respondents sampled for the study, 139 (53.5%) were from the clinical department, 21 (7.9%) were from dispensary, 63 (24.4%) were from the maternity section, 18 (7.1%) from the administrative section, 18 (7.1%) were from the IT department, 1 respondent did not indicate department hence captured as missing system. The respondents who were nurses were 194 (74.8%), medical doctors were 18 (7.1%), biostatistician were 18 (7.1%), administrators were 10 (3.9%), and laboratory technicians were also 18 (7.1%), 2(0.8%) did not indicate their positions hence captured as missing system.

The years of service was also of great importance as it indicates the level of experience the respondents had with the various hospitals so as to offer a more reliable information to the

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study. From the analysis, 43 (16.5%) of the respondents had been with their respective hospitals for less than a year, 100 (38.6%) had worked for 1-5 years with their respective hospitals, 78 (29.9%) had also worked for 6-10 years, whiles 34 (12.9%) had worked for more than 10 years. Over 80% of the respondents have therefore worked for more than a year in their hospitals, and may have had the necessary information needed for the study. 5(1.9%) did not indicate their length of engagement at their several hospitals, hence captured as missing system.

The age distribution indicates that, 72 (27.6%) of the respondents were aged 18-25 years, 164 (63.0%) were also aged 26-40 years, and 24 (9.4%) of the respondents were also aged above 40 years. Regarding the gender, 94 (36.2%) were males, whiles 166 (63.8%) were females. Female health workers therefore dominated the study.

On the level of education of respondents, Diploma holders were 172 (66.1%), Degree holders were 59 (22.8%), and Masters' degree holders were also 29 (11%).

Table 4.1 Demographics of Respondents

Variable	Category	Frequency	Percentage
Depart/ Unit of Work	Clinical department	139	53.5
	Dispensary	21	7.9
	Maternity	63	24.4
	Administration	18	7.1
	IT department	18	7.1
	Missing system	1	0.4

Position/ Role at Work	Nurse	194	74.8
	Doctor	18	7.1
	Biostatistician	18	7.1
	Administrator	10	3.9
	Laboratory technician	18	7.1
	Missing System	2	0.8
Years of Engagement	Less than 1 year	43	16.5
	1-5 years	100	38.6
	6-10 years	78	29.9
	More than 10 years	34	12.9
	Missing System	5	1.9
Age of Respondents	18-25 years	72	27.6
	26-40 years	164	63.0
	Above 40 years	24	9.4
Gender of Respondents	Male	94	36.2
	Female	166	63.8
Respondents' Level of Education	Diploma	172	66.1
	Degree	59	22.8

		29	11.0
	Post graduate		

Source: Researcher's field work (2018)

4.2 Data Validity And Reliability

Reliability and validity is used to reduce the risk of bias responses when applying a theory to empirical findings. According to Saunder *et al.* (2003), reliability differs from validity in the sense that reliability has to `do with generalisation of the result and validity has to do with whether the observation shows reality. The reliability of collected data was tested using Cronbach's alpha. This standard test show the level of internal consistency of the data collected for each variable. Variables with the conventional internal consistency level of 0.7 and above will be accepted and used for further analysis. From Table 4.2, all constructs had an alpha score of greater than 0.7, and were therefore considered reliable for further analysis as presented in chapter four.

Table 4.2 Reliability Analysis

Variable	Number of Items	Cronbach's Alpha
Standard factors	7	0.812
Organisation factors	11	0.909
Environmental factors	5	0.870

Source: Researcher's field work (2018)

4.3 Standard Factors Influencing the Adoption Process of Health Information

Technology

As part of the study, the first objective was to assess the standard factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare organisations. The respondents were given some statements, of which they were to respond on a scale of *1-Strongly Disagree, 2 Disagree, 3Neutral, 4-Agree 5-Strongly agree*. Mean scores and standard deviations were used in assigning meaning to the data gathered. The higher the mean scores therefore, the higher the respondents were in agreement with the statement. Table 4.3 presents the analysis on the standard factors. Out of the seven statements offered respondents under the standard factors, six had a mean score of greater than 3.5 (which is approximately 4), indicating an agreement to these six statements. From the analysis presented in Table 4.3, respondents agreed that, the ability to pilot, demonstrate or use other methods to test out a new IT system and it's conformity to existing infrastructure influence it adoption. The mean score was 3.75 (which was approximately 4 – agree). The flexibility of the information technology therefore, influences its adoption by the health facilities.

The study identified that, the observability of information that is available regarding health data standards influence the adoption decision of the health information technology (mean was 3.67). Meaning a well-defined standards also significantly influenced which health information technology hospitals will adopt. As the flow of information is necessary for creating positive expectations, Thomas *et al*., (2008) indicated that the lack of related information with regard to new standards might hinder the diffusion of the standards amongst potential adopters at various geographical and cultural settings.

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Systems Integration of IT infrastructure to support a new health standard was found as influential in the adoption process of that standard. The mean score was 3.65. The ability of firm to successfully adopt health information technology rests on the ability of the information technology to fully integrate into the existing systems of the hospital. That is, the compatibility of a new information technology into standards to existing information technology infrastructure was very critical in the adoption process (mean was 3.63). Adebesin *et al*. (2013) emphasized that health data standards are the critical foundation for creating and aggregating a patient-centric EHR system, building national health information networks, interchanging data among independent sites, and creating a population database for health surveillance. All these could be difficult to integrate, thereby becoming a major barrier in adoption of health standards particularly in developing countries.

For every investment, firms would want to reap the maximum benefit. And so is it with health organizations. The study found out that, the relative advantage of a particular information technology standard influence its adoption (mean was 3.61). The complexity of using a particular information technology standard also influenced its adoption (mean was 3.60).

The study however showed that, respondents were indifferent that the cost of switching or adopting a new standard significantly influence the decision to adopt the standard. The mean score of 3.39 was approximately 3 (indifferent).

Table 4.3 Standard Factors

Variables	N	Min	Max	Mean	SD
The ability to pilot	260	1	5	3.75	.997

Observability of information that is available regarding health data standards	260	1	5	3.67	1.053
Systems Integration of IT infrastructure	260	1	5	3.65	1.056
Compatibility of a new IT standards to existing IT infrastructure	260	1	5	3.63	1.224
Relative Advantage of a particular IT standard	260	1	5	3.61	1.178
Complexity of using a particular IT standard	260	1	5	3.60	1.192
The cost of switching or adopting a new standard	260	1	5	3.39	1.284

Source: Researcher's field work (2018)

4.4 Organisational Factors Influencing the Adoption Process of Health Information Technology

The second objective of this study was also to ascertain the organisational factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare organisations. Just like section 4.3, the respondents were given some statements, of which they were to respond on a scale of *1-Strongly Disagree, 2 Disagree, 3Neutral, 4-Agree 5-Strongly agree*. Mean scores and standard deviations were used in assigning meaning to the data gathered. The higher the mean scores therefore, the higher the respondents were in agreement with the statement. Table 4.4 presents the analysis on the organisational factors.

There were 11 items under this section, and the mean scores indicated an agreement to all these statements. From the analysis, it was agreed that, lack of information formed a key basis for the adoption of health information technology (mean score was 3.92). Having enough information about the cost, functions, operations, etc., a particular health information technology, makes decision regarding its choice smooth.

Every healthcare has its unique needs, which would influence which information technology would be suitable for its operations. The operational needs of public, private, mission or quasi hospitals may have different operational needs, and therefore different health information technology needs. The mean score for this was 3.90.

The hospitals ability to analyse the data generated by the health information technology also influenced its adoption. Health information technology collects large amount of data, of which could also be meaning when analysed appropriately. The hospital's ability to see the usefulness of all large data generated by health information technologies will determine their interest in investing in it. The mean score was 3.90.

Change management is a very critical issue of consideration when implementing new system of any form, and health information technology is not an exception. New system implementations could be met with resistance to change from users. This resistance could greatly affect the implementation of information technology (mean was 3.85). This is also related to lack of clinicians' engagement, which had a mean score of 3.82.

The existing health information technology infrastructure at the hospitals, such as internet, computers, servers, LAN connections, electricity, etc., greatly affects the adoption of health information technology (mean was 3.77). The availability of these infrastructures smoothens the adoption process of health information technology.

The preparedness of the users of health information technology is much dependent on how well they are educated in that area. For an effective health information technology adoption, there must be training and education on the system. When users are much conversant with the proposed new system, the chances of change resistance greatly reduces. The mean score was also 3.69. Khoumbati *et al*. (2006) also advocated that the availability of professionals,

with regard to technical aspects, is an essential attribute to the success of the adoption of enterprise application integration in healthcare organisations. Just as with any other organisation, hospitals also have their own cultures which influences the way they operate. Hospitals that are more open to new ideas and new ways delivering health service are more likely to easily adopt health information technology. Orgnisational culture had a mean score of 3.67. For example, Fichman (2004) indicated that, organisations which have extensive experience of failure regarding the adoption of beneficial innovations will become less well adapted and may become laggards to innovation.

Accreditation could also be another major consideration in the adoption of health information technology. Hospitals without accreditation may not be allowed to offer some health service and may therefore not need some kind of information technology support in their operations. The mean score was 3.67.

Size of healthcare hospital is usually correlated with their ability to have the necessary funds for health information technology adoption. The size of the hospital also usually determines the range of health service they provide and the health information technology that will be needed. The mean score was 3.65. As also found by Fichman (2004), large organisations are rich in terms of the essential resources (e.g. financial and/or human) required to invest in the implementation of an innovation. Finally, the lack of adequate policies and procedures on health information technology could also influence its adoption (mean was 3.65).

Table 4.4 Organisation Factors

Variables	N	Min	Max	Mean	SD
Lack of information	260	1	5	3.92	1.021
Type of healthcare organisation	260	1	5	3.90	1.112
Data analysis	260	1	5	3.90	.953

Resistance to change	260	1	5	3.85	1.030
Lack of clinicians engagement	260	1	5	3.82	1.255
HIT infrastructure	260	1	5	3.77	1.207
Education	260	1	5	3.69	1.095
Orgnisational culture	260	1	5	3.67	1.233
Accreditation	260	1	5	3.67	1.149
Size of healthcare organization	260	1	5	3.65	1.032
Lack of adequate policies and procedures	260	1	5	3.65	1.079

Source: Researcher's field work (2018)

4.5 Environmental Factors Influencing the Adoption Process of Health Information Technology

The last objective of this study was also to ascertain the environmental factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare organisations. Just like the previous sections, the respondents were given some statements, of which they were to respond on a scale of *1-Strongly Disagree, 2 Disagree, 3Neutral, 4-Agree 5-Strongly agree*. Mean scores and standard deviations were used in assigning meaning to the data gathered. The higher the mean scores therefore, the higher the respondents were in agreement with the statement. Table 4.5 presents the analysis on the environmental factors.

There were 5 items under this section, and the mean scores indicated an agreement to all these statements. From the analysis, it was agreed that, national healthcare system policy by government influence the decision to adopt health information technology, with a mean score

of 3.84. The government and its ministries have some level of influence on the operations of public hospitals, and therefore, government policies have a direct influence on the adoption of health information technology. This is largely because government is usually the financier of these health institutions. For example, in 2009, the government of Ghana through the Ministry of Health introduced that the National eHealth Strategy to guide eHealth implementation in Ghana (MOH, 2010).

Human resources are the most important assets that contribute to organizational success. However, as indicated by Pare (2007), with the introduction of complex and rapidly evolving technology, organizations oftentimes are limited by the scarcity of skilled employees and experienced managers needed to operate the newly introduced information technologies. The study found the lack inadequacy of professionals to operationalize a standard was crucial in the decision to adopt a standard (mean score was 3.78). Similarly, external pressure from government policy or supervisory agency also influenced the adoption of a health standard (mean was 3.63).

The lack of national plan for Medical Data Exchange influence the adoption of a health standards (mean was 3.70). And lastly, the availability of national regulator influence the adoption of a health data standard (mean was 3.50). Zhang *et al.* (2007) pointed out that, the existence of a government policy and strategic plan is an important factor in supporting interoperability between health information technology, and essential in facilitating the acquisition of health information technology applications that incorporate such standards.

Table 4.5 Environmental Factors

Variables	N	Min	Max	Mean	SD
National healthcare system policy by government	260	1	5	3.84	1.074

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Shortage of Professionals to operationalize a standard	260	1	5	3.78	1.212
Lack of National Plan for Medical Data Exchange	260	1	5	3.70	1.086
External pressure from government policy or supervisory agency	260	1	5	3.63	1.230
Availability of National Regulator	260	1	5	3.50	1.119

Source: Researcher's field work (2018)

All the variables in table 4.5 comprise environmental factors and they have influenced the adoption of HIT at the health facilities.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This final chapter entails the summary of findings, conclusions based on the findings and recommendation based on the study findings. The purpose of this study was to examine the factors influencing the adoption process of health information technology related data standards in Ghanaian healthcare institutions. The study focused on 10 healthcare facilities within Ashanti region, of which these were either quasi, public, private or mission health facilities.

5.1 Summary of Findings

5.1.1 Standard Factors Influencing the Adoption Process of Health Information

Technology

The standard factors that influenced the adoption of health information technology among the selected health facilities in Ashanti region were the ability to pilot the new system, observability of information that is available regarding health data standards, systems integration with existing IT infrastructure, compatibility of a new IT standards to existing IT infrastructure, relative advantage of a particular IT standard, and the complexity of using a particular IT standard.

5.1.2 Organisational Factors Influencing the Adoption Process of Health Information Technology

The organisational factors that influenced the adoption of health information technology among the selected health facilities in Ashanti region were the availability of the necessary information regarding the new health information technology, the type of healthcare organisation (whether private, public, quasi or missionary), availability of data analysis experts, resistance to change, level of clinicians engagement, existing health information technology infrastructure, education and training new system, orgnisational culture, accreditation status, size of healthcare organization and the adequacy of policies and procedures.

5.1.3 Environmental Factors Influencing the Adoption Process of Health Information Technology

The environmental factors that influenced the adoption of health information technology among the selected health facilities in Ashanti region were the existence of national healthcare system policy by government, availability of professionals to operationalize a

standard, availability of national plan for Medical Data Exchange, external pressure from government policy or supervisory agency, and the availability of national regulator.

5.2 Conclusions

The study concludes that, the three main factors (Standard factors, Organisational factors, and Environmental factors) significantly influenced the adoption process of health information technology related data standards in Ghanaian healthcare institutions. Standard factors such as observability of information that is available regarding health data standards, systems integration with existing IT infrastructure, relative advantage of a particular IT standard, and the complexity of using a particular IT standard, greatly influenced hospital's adoption of a health information technology. Organisational factors such as the type of healthcare organisation (whether private, public, quasi or missionary), availability of data analysis experts, resistance to change, and the size of healthcare organization also influenced the adoption of health information technology. Finally, environmental factors like the existence of national healthcare system policy by government, and availability of professionals to operationalize a standard also influenced hospital's adoption of a health information technology.

5.3 Recommendations for Management

After the study, the following recommendations were made;

The ability of healthcare facilities to pilot use a health information technology was ranked as the highest standard influencing factor in determining the adoption of health information technology. The health information technology service providers must therefore make room

for the potential clients (like hospitals) to try out the system on a smaller scale, to judge its effectiveness before purchasing it. This would bring some level of flexibility in the purchase process, and also safes the hospital money, as their funds would not get locked up in health information technology which would not be beneficial to their needs after purchase.

Resistance to change has always been seen as a major factor in the adoption of new systems, and the adoption of health information technology was not an exception. This usually stems from inadequate information, misinformation, fear of losing job, inadequate training and skill enhancement, etc. Hospitals aiming at adopting health information technology should ensure to effectively communicate with their staff on the benefits of the new system, and training them adequately to operate the new systems, as these will help reduce the chance of change resistance.

The government through its ministries, greatly influenced the adoption of health information technology among hospitals. The government must therefore periodically review the information technological needs of the entire nation, and put in measures to boost its usage. For example, the government could invest in information technology infrastructure (like internet and reliable power supply), which would serve as a bedrock for the hospitals to adopt health information technology. Policies must be made to enhance the adoption of health information technology.

5.4 Recommendations for Further Studies

The current study was purely quantitative and as such limits the inclusion of opinions outside the questionnaire into the study. Future studies could consider a mixed approach, when in-depth discussion from the respondents could be included. Future studies could also

comparing the results of Ashanti region to other regions, for the purpose of generalisation. Also another factor that can be considered aside the factors used in this study is political factor, another research could include this factor in determining the adoption of HIT related standards.

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APPENDIX

Questionnaire

Dear Sir / Madam,

I'm Faustus Apiribu, a student of KNUST working on my dissertation for an award of

Masters of Health Informatics.

This study is about the FACTORS INFLUENCING THE ADOPTION OF HIT RELATED STANDARDS AT THE DECISION- MAKING STAGE OF HOSPITALS IN ASHANTI REGION. The information you will give is purely for academic purposes and will be treated with confidentiality.

Your participation is purely voluntary and has no monetary value. The report produced will be intended mainly for academic purposes shared with the University and Ashanti regional health office to understand the constraints in the process of adoption of Health information technology. This information will be used for decision making to support the design for appropriate interventions. Thanks for taking time and answering the questionnaire .

SECTION A: BACKGROUND INFORMATION

The section below will require you to tick the most appropriate option that best describes you for faster compilation in this inquiry.

1. Name of Hospital …………………………………………………………..
2. Type of Hospital

Mark only one oval.

[ ] Public

[ ] Private

[ ] Mission

[ ] Quasi

3. Age of the respondent Mark Only one oval.

[ ] 18-25

[ ] 26-40

4. Gender of respondent Mark Only one oval.

[ ] Male

[ ] Female

5. Department/Division of affiliation Mark only one oval.

[ ] Clinical department

[ ] Dispensary

[ ] Maternity

[ ] Administration

[ ] I T department

6. Level of education Mark Only one oval Diploma

Degree

[ ] Post graduate

[ ] Masters and above

[ ]

[ ] 7.   What is your Job Title Mark only one oval.

☐ Nurse

☐ Doctor

☐ Biostatistician

☐ Administrator

☐ Laboratory technician

8. For how long have you been working at this facility.

Mark only one oval.

☐ Less than 1 year

☐ 1-5 years

☐ 6-10 years

☐ 11 +

9. Please indicate in your view how the following factors affect the decision making process to adopt health information technologies at your facility (Standard factors) I would like to know your opinion how you agree with statements. There is no right or wrong answer. Only express your opinion using the Likert scale; 1-Strongly Disagree, 2 Disagree, 3Neutral, 4-Agree 5-Strongly agree. Mark only one oval per row.

Standard factors	1	2	3	4	5
Relative Advantage of a particular IT standard influence its adoption					
Complexity of using a particular IT standard influence its adoption					

Compatibility of a new IT standards to existing IT infrastructure influence it adoption					
The ability to pilot, demonstrate or use other methods to test out a new IT system and it's conformity to existing infrastructure influence it adoption					
Observability of information that is available regarding health data standards influence the adoption decision of the health standard					
The cost of switching or adopting a new standard significantly influence the decision to adopt the standard					
Systems Integration of IT infrastructure to support a new health standard is influential in the adoption process of that standard					

10. Please indicate in your view how the following factors affect the decision making process to adopt health information technologies at your facility (Organisation Factors).

Only express your opinion using the Likert scale; 1-Strongly Disagree, 2 Disagree, 3Neutral, 4-Agree 5-Strongly agree. Mark only one oval per row.

Organisation Factors	1	2	3	4	5
Type of Healthcare Organisation					
Size of Healthcare Organization					
Organizational					
Culture Orqnisational Structure					

	1	2	3	4	5
Lack of Adequate Policies and Procedures					
Resistance to Change					
Education					
HIT infrastructure					
Lack of information					
Accreditation					
Data analysis					
Lack of clinicians engagement					

11. Please indicate in your view how the following factors affect the decision making

    process to adopt health information technologies at your facility (Environmental

    Factors). Only express your opinion using the Likert scale; 1-Strongly Disagree, 2
    Disagree, 3Neutral, 4-Agree 5-Strongly agree. Mark only one oval per row.

Environmental Factors	1	2	3	4	5
External pressure from government policy or supervisory agency influence the adoption of a health standard					
National healthcare system policy by government Influence the decision to adopt healthcare standards					

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Lack of National Plan for Medical Data Exchange influence the adoption of a health standard					
Lack of National Regulator influence the adoption of a health data standard					
Shortage of Professionals to operationalize a standard is crucial to the decision to adopt a standard					

THANK YOU…!