An investigation into the Impacts of Adopting HIT-related EHRs/EMRs on Saudi Healthcare Systems Among Private and Public Hospitals: A Comparative Analysis

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An investigation into the Impacts of Adopting HIT-related EHRs/EMRs on Saudi Healthcare Systems Among Private and Public Hospitals: A Comparative Analysis

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Declaration

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Doctor of Philosophy is entirely my own work, that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

Name: Ahmad Aljohani   Sign.   ID No.:   Date:

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Publications

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Aljohani, A., Davis, P., and Connolly, R. (2017). An investigation into the adoption of Health Information Technology (HIT): A case study in Saudi Arabian Public Hospitals. *In: The International Conference on Communication, Management and Information Technology (ICCMIT'17) 3-5 April 2017, University of Warsaw, Warsaw, Poland.*

Aljohani, A., Davis, P., and Connolly, R. (2017). An investigation into the adoption of Health Information Technology (HIT) to improve healthcare management system in Saudi Hospitals. In*: 6th Annual Limerick Postgraduate Conference (LPRC) 24th May 2017, Limerick Institute of Technology, Limerick, Ireland.*

Definitions

All definitions approved by scholars are always not symmetric; the uncertain main terms are explained here in order, to begin with a clear position, which is taken in this study. Therefore, it is essential that the main terms used in the thesis be primarily defined in the light of explanations offered by the author. These terms will be discussed further in the context of the literature review in chapter two. However, at this stage, it is necessary to clearly define what is meant by the main concepts, as these are essential to the clarity of the researcher's position.

The definition of technology

Both Daft and Macintosh (1977) define technology as

> "*The basic task of the organisation, subunit technologies, and the tools and techniques associated with individual job technologies, it also could be work-flow or the tools, equipment, and work-related tasks within an organisation used to frame form inputs into outputs."* (Daft and Macintosh, 1977, p.82).

Moreover, Orlikowski (1992) defines technology as

> *"The 'hardware,' that is the equipment, machines, and instruments that humans use in a productive activity, both industrial and informational."* (Orlikowski, 1992, p.398)

For this research, the definition offered by Daft and Macintosh will be used.

The definition of Information Technology (IT)

According to Daft and Macintosh, IT is

> *"The use of hardware and software to manage and manipulate data and information consists of devices that input process, an output data, and information"* (Daft and Macintosh, 1977, p.84).

Aksoy and Denardis (2007) describe IT as

> *"A system of hardware and software that processes, exchanges, stores, and presents information, using electrical, magnetic, and electrometric energy."* (Aksoy and DeNardis, 2007, p8).

For this research, the definition offered by Daft and Macintosh will be used.

The definition of Information and communication technology (ICT)

Information and communication technology (ICT) is defined by Razani (2012) as

> *"An umbrella term that includes any communication device or application such as radio, television, cellular phone, computers, network hardware and software, and satellite systems, as well as various services and applications associated with these devices"* (Razani, 2012, p.5)

According to the World Bank Group in April 2002, ICT is defined as

> *"The technology that consists of the hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of various forms of voice, data, text, or image information."*

For this research, the definition offered by Razani (2012) will be used.

The definition of Healthcare Information Technology (HIT)

According to Ciampa and Revels (2013), HIT is defined as

> *"The use of hardware and software to manage and manipulate health data and information."* (Ciampa and Revels, 2013, p.4).

Davis and Lacour define HIT as

> *"The speciality in the field of health information management that focuses on the day-to-day activities of health information management that supports collection, storage, retrieval, and reporting of health information."* (Davis and LaCour, 2014, p.10).

For this research, the definition offered by Ciampa and Revels will be adopted.

Table of Contents

Chapter one: Introduction 1
1.1 Introduction 2
1.2 Research Background 2
1.3 Research Context 7
1.5 Research Questions 9
1.6 Research Scope 10
1.7 Research Contributions 12
1.8 Research Methodology 12
1.9 Thesis Outline 13
1.10 Conclusion 13

Chapter two: Literature review 15
2.1 Introduction 17
2.2 The Research Background and Framework 19
2.3 Literature review 20
2.4 Definitions 22
2.4.1 The definition of technology 22
2.4.2 The definition of Information Technology (IT) 23
2.4.3 The definition of Information and communication technology (ICT) 23
2.4.4 The definition of Healthcare Information Technology (HIT) 24
2.5 Health Information Technology (HIT) 24
2.5.1 The benefits of using HIT 25
2.5.2 Types of HIT 26
2.5.2.1 Electronic Medical Records/Electronic Health Records (EMRs/EHRs)... 26
2.5.2.2 Differences between EHRs and EMRs 27
2.5.2.3 Personal Health Records (PHRs) 29
2.5.2.4 E-prescribing 29
2.5.2.5 Computerized Provider (Physician) Order Entry (CPOE) 30
2.5.2.6 E-health 31
2.6 The key critical factors in the adoption of HIT-related EMRs/EHRs 33
2.6.1 Technical factors 33
2.6.2 Social factors 34
2.6.3 Organizational and administrative factors 36
2.7 The impacts of HIT on healthcare systems 39
2.7.1 The impacts on quality of care and patient safety 40
2.7.2 The impacts on efficiency and clinical decision-making 41
2.7.3 The impacts on time and cost saving 42
2.7.4 The impact on patient empowerment 43
2.8 Barriers and Risks of using HIT 46
2.9 Review theories behind ICT system Implementation and Adoption 55
2.9.1 Technology Acceptance Model (TAM) 57
2.9.2 Theory of Reasoned Actions (TRA) 60
2.9.3 Theory of Planned Behaviour (TPB) 63
2.9.4 Unified Theory of Acceptance and Use of Technology (UTAUT) 65
2.9.5 Diffusion of Innovation Theory 66
2.9.5.1 Innovation 69
2.9.5.1.1 Communication Channels 70
2.9.5.1.2 Time 70
2.9.5.1.3 Social System 70
2.9.5.2 The innovation adoption decision 73

2.9.5.2.1 The Knowledge Stage 74
2.9.5.2.2 The Persuasion Stage 75
2.9.5.2.3 The Decision Stage 76
2.9.5.2.4 The Implementation Stage 77
2.9.5.2.5 The Confirmation Stage 78
2.9.5.3 Characteristics of the Innovation Organization 79
2.9.5.3.1 Relative Advantage 80
2.9.5.3.2 Compatibility 80
2.9.5.3.3 Complexity 81
2.9.5.3.4 Trialability 81
2.9.5.4 Uncertainty and perceived risk 81
2.9.5.5 Values, Beliefs, and Attitudes 82
2.9.5.6 Resistance to adoption 83
2.9.5.7 Information sources 84
2.10 Diffusion of Health Care Innovation 86
2.10.1 The Healthcare Innovation 86
2.10.2 The Process of Healthcare Innovation 88
2.11 EHRs Integration 90
2.12 HIMSS evaluation 91
2.13 The Gaps in the Literature 94
2.14 Conclusion 97

Chapter Three: Research Methodology and Design 98
3.1 Introduction 100
3.2 Research objectives 101
3.3 Research philosophy 103
3.3.1 Positivism 104
3.3.2 Interpretivism 104
3.4 Research design 105
3.5 Research Paradigm 107
3.5.1 Ontology 107
3.5.2 Epistemology 108
3.6 Qualitative Research Method 109
3.6.1 The Reasoning behind the Selection of Qualitative Research 111
3.6.2 Justifying the Use of the Case Study Methodology 112
3.6.3 Documentation 115
3.7 Ethical compliance 116
3.8 Participants Selection 117
3.9 Choice of healthcare sectors 119
3.10 Data Collection 119
3.10.1 Structure of the interviews 119
3.10.2 Semi-structured interviews 120
3.10.3 Question types 121
3.10.4 Pilot interview 122
3.10.5 Main Interviews 123
3.10.6 Audio Recordings and Transcriptions 124
3.10.7 Contact summary sheet 124
3.11 Data analysis 124
3.11.1 The coding processes 125
3.11.1.1 Step one: Data reduction to create summary codes 126
3.11.1.2 Step two: Using summary codes grouped to determine conceptual labels 127

3.11.1.3 Step three: Conceptual labels grouped with matches and relationships to create thematic ... 128
3.11.1.4 Step Four: Cross case study analysis ... 128
3.12 Conclusion ... 130

Chapter four: Data Analysis and Findings ... 131
4.1 Introduction ... 133
4.2 Saudi Arabian Healthcare System ... 133
4.2.1 Health Information Technology (HIT) in Saudi Arabia ... 135
4.2.2 Al-Madinah Al-Munawarah Region ... 136
4.3 Case Study One: Ohud Hospital ... 139
4.3.1 Background ... 139
4.3.2 The interview results ... 141
4.3.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs 141
4.3.2.1.1 Technical factors ... 141
4.3.2.1.2 Social factors ... 144
4.3.2.1.3 Organizational and administrative factors ... 147
4.3.2.2 Theme two: the impacts of HIT-related EMRs on health care ... 151
4.3.2.3 Theme three: the model of adoption EMRs ... 155
4.4 Case Study Two: King Fahad Hospital ... 157
4.4.1 Background ... 157
4.4.2 The interview results ... 158
4.4.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs 158
4.4.2.1.1 Technical factors ... 158
4.4.2.1.2 Social factors ... 162
4.4.2.1.3 Organizational and administrative factors ... 164
4.4.2.2 Theme two: the impacts of HIT-related EMRs on health care ... 168
4.4.2.3 Theme three: the model of adoption EMRs ... 173
4.5 Case Study Three: Saudi German Hospital ... 175
4.5.1 Background ... 175
4.5.2 The interview results ... 177
4.5.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs 177
4.5.2.1.1 Technical factors ... 177
4.5.2.1.2 Social factors ... 180
4.5.2.1.3 Organizational and administrative factors ... 181
4.5.2.2 Theme two: the impacts of HIT-related EMRs on health care ... 183
4.5.2.3 Theme three: the model of adoption EMRs ... 189
4.6 Case Study Four: Mouwasat Hospital ... 190
4.6.1 Background ... 190
4.6.2 The interview results ... 191
4.6.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs 191
4.6.2.1.1 Technical factors ... 191
4.6.2.1.2 Social factors ... 194
4.6.2.1.3 Organizational and administrative factors ... 195
4.6.2.2 Theme two: the impacts of HIT-related EMRs on health care ... 197
4.6.2.3 Theme three: the model of adoption EMRs ... 201
4.7 Cross-case analysis ... 203
4.7.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs 204

4.7.1.1 Technical factors 204
4.7.1.2 Social factors 205
4.7.1.3 Organizational and administrative factors: 206
4.7.2 Theme two: the impacts of HIT-related EMRs on healthcare 215
4.7.3 Theme three: the model of adoption of EMRs 220
4.8 **Conclusion** **227**

Chapter Five: Discussion **228**
5.1 **Introduction** **230**
5.2 Research objectives **231**
5.3 Discussion **232**
5.3.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs 233
5.3.1.1 Technical factors 233
5.3.1.2 Social factors 235
5.3.1.3 Organizational and administrative factors 237
5.3.2 Theme two: the impacts of HIT-related EMRs on healthcare 241
5.3.3 Theme three: the model of adoption of EHRs/EMRs 252
5.4 Lessons learnt from case studies **253**
5.5 Discussion of the findings and implications for theory and practice **261**
5.5.1 Implications for Theory 261
5.5.2 Implications for Practice 269
5.6 Conclusion **274**

Chapter six: Conclusion **276**
6.1 Introduction **277**
6.2 The contribution and novelty of this research **278**
6.3 **Recommendations** **281**
6.4 Limitations of the research **284**
6.5 Directions for future research **285**
6.6 Conclusion **287**

References **288**

Appendix A: Ethical Approval DCU **310**

Appendix B: Ethical Approval MoH **311**

Appendix C: Informed Consent Form **312**

Appendix D: Plain Language Statement **314**

Appendix E: Interview Questions Agenda **316**

Appendix F: An example of the coding process **319**

Appendix G: Conducting, analysing and coding **322**

Appendix H: Author's Publication **323**

List of Figures

Figure 1-1: The three primary research fields are drawn upon for this research 7
Figure 1-2: Overview of Research Agenda 11
Figure 1-3: The structure of the thesis layout. 14
Figure 2-1: Chapter structure 16
Figure 2-2: The literature review structure 18
Figure 2-3 Technology acceptance model (TAM) by (Davis 1989, p. 984) 58
Figure 2-4: Technology acceptance model (TAM) 2nd edition 58
Figure 2-5: Technology acceptance model (TAM) 3rd edition 59
Figure 2-6: Theory of reasoned action (TRA) by (Ajzen & Fishbein, 1980 p. 47). 60
Figure 2-7: Theory of planned behaviour by Ajzen (1991, p. 182) 63
Figure 2-8: Unified theory of acceptance and use of technology (UTAUT) by Venkatesh *et al.* (2003, p. 447). 65
Figure 2-9: Present of adoption and source by Rogers, 2010. (Fichman and Kemerer, 1999, p.11) 72
Figure 2-10: The innovation-decision process initiates source by Rogers, 2010 (Sahin, 2006, p.170). 74
Figure 2-11: Adopter Categorization by (Rogers, 2010, p. 247) 78
Figure 2-12 Conceptual Framework for Innovation in Healthcare (Omachonu and Einspruch, 2010, p.10) 87
Figure 2-13: The process of healthcare innovation (Omachonu and Einspruch, 2010, p.36). 89
Figure 2-14 Research Model 96
Figure 3-1 Chapter Structure 99
Figure 3-2: Research Framework 101
Figure 3-3: Theoretical research strategy framework and the selected options 102
Figure 3-4: Research Design 106
Figure 3-5: The management levels by (Koontz, 2010, p.4) 117
Figure 4-1 Chapter Structure 132
Figure 4-2: The number of healthcare organisations in Saudi Arabia as per. The Ministry of Health (MoH, 2014, p.86). 134
Figure 4-3: Madinah Region 136
Figure 5-1: Chapter Structure 229
Figure 5-2: TAM suggested for this study 262
Figure 5-3: Research Model 275

List of Tables

Table 2-1 The key differences between EHRs and EMRs (Garets and Davis, 2006, p.3). 28
Table 2-2: The key critical factors to adopt HIT 38
Table 2-3 Summary the key findings of the impacts 45
Table 2-4: The key differences between privacy and security. 51
Table 2-5: Key Barriers and Risk of using HIT 54
Table 2-6: Review theories behind ICT system Implementation and Adoption 56
Table 2-7: The summary of the ICT system implementation and adoption theories. 85
Table 2-8: EMR Adoption Model Evaluation (Hersh and Wright, 2008, p.304). 93
Table 3-1: The most common types of case studies 113
Table 4-1: The critical factors influencing the adoption of HIT-related EMRs 214
Table 4-2: The impacts of HIT-related EMRs on health care 219
Table 4-3: Comparison of EHRs/EMRs functionality of four case studies 224
Table 4-4: The model of adoption of HIT-related EMRs 226

Glossary of Abbreviations

CPOE	Computerized Provider (Physician) Order Entry
DOI	Diffusion of Innovations
EMRs	Electronic Medical Record system
EHR	Electronic Health Records
HIS	Health Information System
HFMA	Health Financial Management Association
HIT	Health Information Technology
HIMSS	Healthcare Information and Management Systems Society
ICT	Information and communications technology
JCI	Joint Commission International
KFH	King Fahad hospital
MIS	Management Information Systems
OH	Ohud Hospital
OASIS	Open Architecture Specialized Information System “HMIS” Hospital Management Information System
OPD	Out Patient Department
PHR	Personal Health Record
RHIO	Regional Health Information Organization
REC	Research Ethics Committee
TAM	Technology Acceptance Model
MoH	The Ministry of Health
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Actions
UTAUT	Unified Theory of Acceptance and Use of Technology (UTAUT)

Abstract

An investigation into the Impacts of Adopting HIT-related EHRs/EMRs on Saudi Healthcare Systems Among Private and Public Hospitals: A Comparative Analysis

Ahmad Aljohani

In the last decade, healthcare in Saudi Arabia has been significantly improving. This has been accompanied by advancements in the field of Information and Communications Technology (ICT). In particular, Saudi Arabia has seen the recent introduction of health information systems in healthcare organisations, namely, the Electronic Health Record System (EHRs) and the Electronic Medical Record System (EMRs). These systems offer a number of potential benefits, such as the reduction of medical costs; however, the health organisations in question face limitations when it comes to reaping these benefits, due to the challenges surrounding their implementation. In order to reduce these challenges, a high level of interoperability between different organisations' systems is required. To make this possible, this study illustrates the applicability required regarding an adoption model for a unified health information system.

Based on a review of the literature on the diffusion of innovation, there are several factors that influence the adoption of HIT, which needs to be investigated. These will support implementing health information technology, in particular, EHRs/EMRs. However, the adoption of such EHRs/EMRs as a core technology in healthcare organisations for both private and public hospitals has been significantly developed in recent times, without real practical research, such as an investigation into health information exchange.

The implementation of EHRs has been a necessity for hospitals to achieve objectives, such as enhancing the quality of healthcare provided, heightening patient safety, and reducing the time and cost of healthcare delivery. Additionally, this study widely illustrates that EHRs/EMRs would provide a transformative benefit to the Saudi health system, resulting in improved patient care and greater transparency, as well as improving the decision-making process effectively and efficiently. The purpose of this research is to explore the impact EHRs have in the healthcare industry. After covering the theories of acceptance technology, adoption, and innovation in healthcare, the circumstances surrounding the implementation of a HIT in a developing country, such as Saudi Arabia, will be investigated. Through this study, it was possible to establish several differing factors, which influence the adoption of EHRs. These factors show impacts on time, cost, quality, efficiency, process, and performance. In this thesis, an exploratory, interpretative, multiple-case study methodology is employed to examine the case of Saudi Arabia, in the use of EHRs. This involved twenty interviews, across two public and two private hospitals.

This study contributed at three levels. Firstly, concerning an understanding of the adoption process of HIT, which is lacking in the current literature. Secondly, the research model highlighted key impacts, risks, barriers, issues, and challenges surrounding the implementation of EHRs, and how EHRs are adopted by different health organisations. Lastly, it illustrated the critical factors, which influence the adoption of EHRs in healthcare organisations, and for future integration, as well as giving possible avenues for future research.

Chapter one: Introduction

1.1 Introduction

The purpose of this chapter is to introduce the research topic, research areas, and research questions, while also providing background and general information on the area of research. This chapter begins with an overview of the interoperability impacts that influence the adoption of health information technology (HIT), in both public and private hospitals in Saudi Arabia. This chapter also includes the rationale for conducting this research, as well as the objectives, contributions, questions, gap, and scope in relation to the above. This chapter then ends with an outline of the thesis chapters.

1.2 Research Background

Globally, healthcare costs are rising every year, faster than inflation and faster than most countries can afford (Alijohani *et al.*, 2015). The most significant threat to governments and citizens in delivering sustainable health services is the burgeoning impact of chronic or non-communicable diseases which threaten to overwhelm most developed and developing nations. The growing socio-economic divide between rich and poor is further exacerbating the problem. The World Economic Forum recently recognised at its meeting in “Davos” that this growing problem requires new ways of thinking and new ways of working (Parker and Thomson, 2016). In evaluating Health Care, there are several factors to be measured (Alijohani *et al.*, 2015).

- Patient costs/quality of care
- Diagnostic costs
- Treatment costs
- Accuracy of data
- Quality of data

The incorporation of IT provides distinct advantages for healthcare system operation. According to Ciampa and Revels, Health Information Technology (HIT) is described as "the use of hardware and software to manage and manipulate health data and information" (Ciampa and Revels, 2013, p.4). It is the area of IT involving the design, development, creation, use, and maintenance of information systems for the healthcare industry. Automated and interoperable healthcare information systems are expected to lower costs, improve efficiency and reduce error while also providing better consumer care and service (Ciampa and Revels, 2013). The main differences between Electronic Health Record (EHR) and Electronic Medical Record (EMR), is EHRs a central component of the health IT infrastructure between multiple healthcare organisations. However, the EMR system is an individual's official, digital health record and is shared among multiple facilities inside the healthcare organisation. The other essential elements of the HIT infrastructure are a Personal Health Record (PHR), which is an individual's self-maintained health record and a Regional Health Information Organization (RHIO), which oversees communications among the other elements and unifies them geographically.

In exploiting these systems, it is critical that a standardised approach be taken. One being developed by the likes of medical devices is that of Technology Assessment. Technology Assessment arose in the mid-1960s, from recognition of the critical role of technology in modern society and its potential for unintended and sometimes harmful consequences. Health information assessment scrutinises the effectiveness, appropriateness, and cost of systems. It does this by asking four fundamental questions: does the technology work, for whom, at what cost and how does it compare with alternatives? It is a structured analysis of health technology, a set of related technologies, or a technology-related issue, that is performed to provide input into a policy decision.

It is a multidisciplinary field policy analysis, and as such encompasses the medical, social, ethical and economic implications of the development, diffusion, and use of health technology.

This research is proposed in investigating the adoption of health information technology (HIT). This would be based on several distinct areas of examination: cost impact analysis, risk and barriers, and technical investigation. Consideration of life-cycle costs is also relevant here, which essential to ensure that the assessment framework investigates the total life-cycle costs of the commissioning of the new technology, and takes into account the need to change the technology in the future. There are a wide variety of models available for life cycle costing. Thus, the selection of an appropriate model, not only requires development and consultation internally between stakeholders but also should involve consultation with industry that has developed such models. The commissioning of medical devices and associated technologies is quite complex with many issues must be considered. These may include the existing medical support infrastructure; the supply of services, such as utilities (e.g., re-engineering process) or even staff training. To procure medical devices could be seen in some cases as being a strategic activity. It requires a medium to long-term perspective. The Total Cost of Ownership (TCO) estimation is an example of a tool, which can serve to analyse any indirect costs (Hurkens *et al.*, 2006), and many organizations are trying to achieve the lowest TCO with their suppliers in supporting their strategy, which in turn is seen as integrating purchasing into company policy (Van Weele, 2009).

As part of this research, an evaluation model based on the general principles of realist evaluation (Pawson, 2000, 2002a, b, 2013; Pawson and Tilley, 1997) is proposed. This is an assessment approach originally designed to assess the effects of complex community-based interventions, which correlate with the aims of this study. This approach has been extensively used over the last few years in the health sector, e.g., in studies on the effect of infrastructure on cycling and walking (Ogilvie *et al.*, 2011), suicide prevention (Harris *et al.*, 2013), and wholesale community health reform in London (Greenhalgh *et al.*, 2009). The question put forward by realist evaluation is not "does it work or not?" but rather, "what works, for whom, and in what circumstances?" What would such an evaluation look like? A fundamental principle is that the evaluation model is constructed for the individual project in question; to meet the specific needs of the project, the project participants, and other stakeholders.

Furthermore, realistic evaluations are usually complex and cover several domains. They often combine qualitative methods, or quantitative methods, sometimes in very creative ways. A key insight, which drives realistic evaluation, is that the impact of an intervention depends critically on the context within which it is offered and that knowledge of how this works is of great practical importance. This context includes the specific individual receiving the intervention. This research will focus on this context within the Kingdom of Saudi Arabia. With a population of 26 million residents and an annual growth rate of 2.2%, the healthcare sector needs to cater for a growing population and a concurrent demand for healthcare.

The Ministry of Health (MoH) is the main government agency entrusted with the provision of preventive, curative, and rehabilitative medical services. The Saudi MoH public hospitals provide health care services at primary, secondary, and tertiary levels to all citizens, free of charge (Hasanain et al., 2014b). Approximately 60% of these hospitals are public hospitals, which fall under the jurisdiction of the Ministry of Health, while the remaining 40% are either University hospitals, or are provided by either the private sector or further government departments, such as the Ministry of Defence and Aviation (Hasanain *et al.*, 2014).

ICT plays a significant role in all contemporary economies in Saudi's information and communications technology (ICT) and health information technology (HIT). One of the largest markets among Middle East countries is the ICT market. The Ministry of Communication and Information Technology was formed in 2003, with the Saudi National Plan for ICT announced in 2005. This has the express purpose of controlling, regulating and developing ICT services and plans in improving Saudi Arabian healthcare with the Ministry of Health.

1.3 Research Context

The research undertaken in this thesis operates primarily within the bounds of three different research fields. The research context is to draw the attention of three fields for clear contribution to understanding. This research context based on perceptions, awareness, drivers, impacts and analysis of health information technology on Saudi healthcare public and private organizations. Additionally, the primary context is the information system, which is the basis of this research. Secondly, the area of healthcare management, which based on the controlling of resources including human and IT will be investigated to achieve the goals effectively and efficiently. Lastly, reviews the theories behind ICT system implementation and adoption that need to be considered.

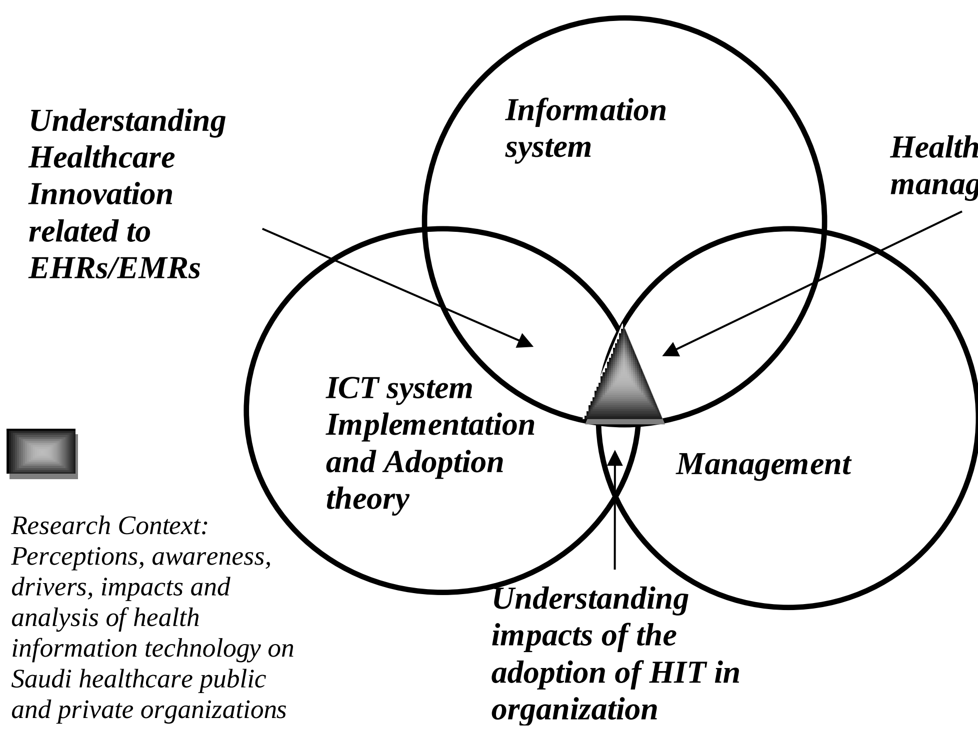


Figure 1-1: The three primary research fields are drawn upon for this research

1.4 Research Objectives

The main purpose of this study is to identify the key issues and factors which come into play during the development and implementation of health information technology (HIT), and to evaluate how the adoption of EHRs/EMRs influences the delivery of healthcare services in private and public hospitals. Furthermore, how these systems affect the organisation and operations shall be analysed. This research will include a traditional review of current literature on this topic, as well as the status of EMRs in Saudi Arabia. This will be followed by an identification of the facilitators of Health Informatics, as well as the barriers that are obstructing EHRs/EMRs implementation. Subsequently, there will be an exploration of the initiatives undertaken by the MoH to facilitate EMRs implementation. Its achievements in the adoption of EMRs, to date, are then outlined.

This research forms the introduction to a work program being developed, for the analysis of the impact of the HIT. The initial research work is focused on the development of model that can be used to assess the impact of technology within a healthcare environment, in terms of management, information system, and social measures. This initial research focuses on the development of HIT, particularly within the context of Saudi Arabia. The objectives of this initial stage are:

1. To conduct a comprehensive literature review related to EHRs/EMRs and Saudi healthcare systems.
2. To review the existing adoption models and consider how these models could be extended or modified to include the adoption process of HIT-related EHRs/EMRs at the decision-making stage.
3. To develop a theoretical model, based on the models identified in Objective two, of the critical factors influencing the adoption of HIT-related EHRs/EMRs in healthcare organisations at the decision-making stage.

4. To identify how current EHRs/EMRs re-adopted in Saudi healthcare organisations.
5. To assess how current EHRs/EMRs in Saudi healthcare organisations are adopted and are being supported.
6. To examine the roles of current EHRs/EMRs adopted in Saudi healthcare organisations.
7. To identify the current impacts, issues, and challenges of Health Information Technology (HIT) on the performance of Saudi healthcare organisations.
8. To identify the critical factors influencing how the current Health Information Technology (HIT) used by Saudi healthcare organisations is adopted and is being supported.
9. To offer recommendations to help promote the adoption of HIT in different health organisations.

1.5 Research Questions

This research introduces a new area that needs to be developed, which will objectively analyse the impact of the HIT. The initial research phase focuses on developing metrics that can be used to assess the impact of eHealth technologies using social measures of technology within a healthcare environment. In particular, the situation of eHealth technologies within Saudi Arabia will be examined. The aim is to assess the theoretical environment, pertinent to this research. By extension, this review aims to illustrate a comprehensive, critical analysis of existing literature, as it applies to this research.

The main research focus is to discover the effect of HIT-related EHRs/EMRs used in Saudi healthcare sectors by answering the following research questions. To address the above research objectives, the views of interviewees will be sought on the significant impacts of HIT-related EMRs.

The main research questions will focus on:

RQ1. What are the critical factors influencing the adoption of HIT-related EHRs/EMRs in healthcare organisations?

RQ2. What are the key issues, impacts, and challenges in the implementation of EHRs/EMRs? Does the current Saudi healthcare system enable the integration of EHRs/EMRs between private and public hospitals?

RQ3. How are EHR/EMR systems adopted by different health organisations and what are their main impacts?

1.6 Research Scope

Within the healthcare management community, the use of HIT is necessary to allow for varying degrees of interoperability between information systems (IS), which all work with varying health standards. Due to this diversity, the scope of this research covers only those health data technologies that are explained in detail, together with their classifications, in Chapter two. However, a broad generalisation based on these examples is beyond the scope of this research. Additionally, these technologies have been necessary for the decision-making process in the adoption of EHRs/EMRs among Saudi healthcare organisations. This study involved four hospitals: King Fahad Hospital, Ohud Hospital, Saudi German Hospital, and Mowasat Hospital in Madinah. These hospitals are chosen because they are key healthcare organisations in the Madinah region and have recently implemented EHRs/EMRs, thus allowing a practical investigation of the practices of using a HIT.

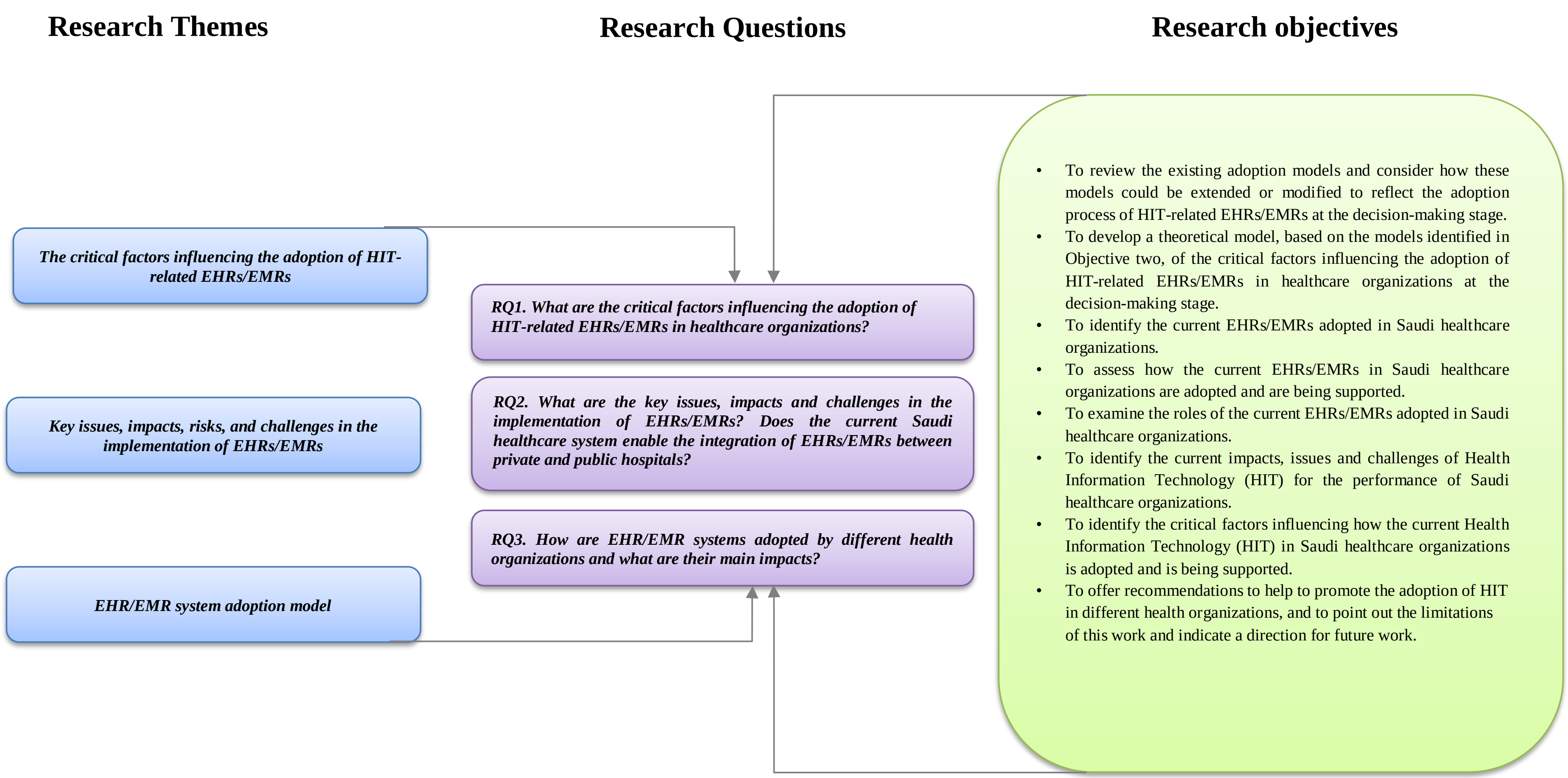


Figure 1-2: Overview of Research Agenda

1.7 Research Contributions

This research provides data on the adoption of health technology implementation and healthcare producers experiences. The research data is collected from twenty participants; whose are responsible for providing research data. Therefore, the major objective of this study is to provide useful information on the internal and external list of the impact of EMR/EHRs on healthcare organisations. The information acquired from the interviews shows the risks related to EMRs, with additional data on how to improve the steps to mitigate such challenges and risks facing EHRs/EMRs integration. This research contributes in three main levels:

1. Identified the critical factors that influence HIT-related EHR adoption.
2. Identified the impacts, barriers, and risks of implementing EHRs and health data integration.
3. Developed framework model for the implementation of EHRs.

1.8 Research Methodology

This research takes a qualitative in-depth interview case study approach, conducted across different healthcare sectors in Saudi Arabia, through organisations located in Madinah. The primary source of data collection is a semi-structured interview. The main reason for choosing this kind of method is that it allows for an in-depth understanding of each case. Consequently, by using interviews, it is possible to build a case study for each hospital in question. Furthermore, using cross-case study analysis and thematic techniques help deepen the understanding of the implementation of HIT applications in both private and public hospitals.

The findings deliver strong descriptive support for the influence of individual characteristics, preparation, and experiences in shaping EHRs/EMRs, and help demonstrate the main impacts, issues, and challenges facing the implementation of HIT-related EHRs/EMRs. This will be followed by cross-case study findings, which allow the main factors influencing the adoption of HIT to be highlighted.

1.9 Thesis Outline

This thesis contains six chapters. Chapter one introduces the objectives, research scope, and research questions of this study. The current literature surrounding this topic is reviewed in Chapter Two, in order to identify the gaps in the understanding of HIT-related EHRs/EMRs and the theories behind such technology adoption. Chapter Three discusses the philosophical assumptions underpinning this study and provides a detailed overview of the stages involved in the collection of data, followed by an outline of the process used to analyse the data via a case study approach. Chapter Four presents the qualitative data analysis procedures and findings across four case studies, as well as the cross-case study findings. Chapter Five discusses the results and contributions of the study and provides a revised research framework, along with several theoretical assumptions. Chapter Six concludes the main contributions of the study and highlights its inherent limitations, along with directions for future research.

1.10 Conclusion

This chapter provided the reader with information about this particular research topic by defining its main terminologies, as well as a background to the research area and the research questions. It provided details regarding the scope of the research study and the potential contributions of the research. Lastly, this chapter outlined the structure of each of the chapters to follow in this thesis.

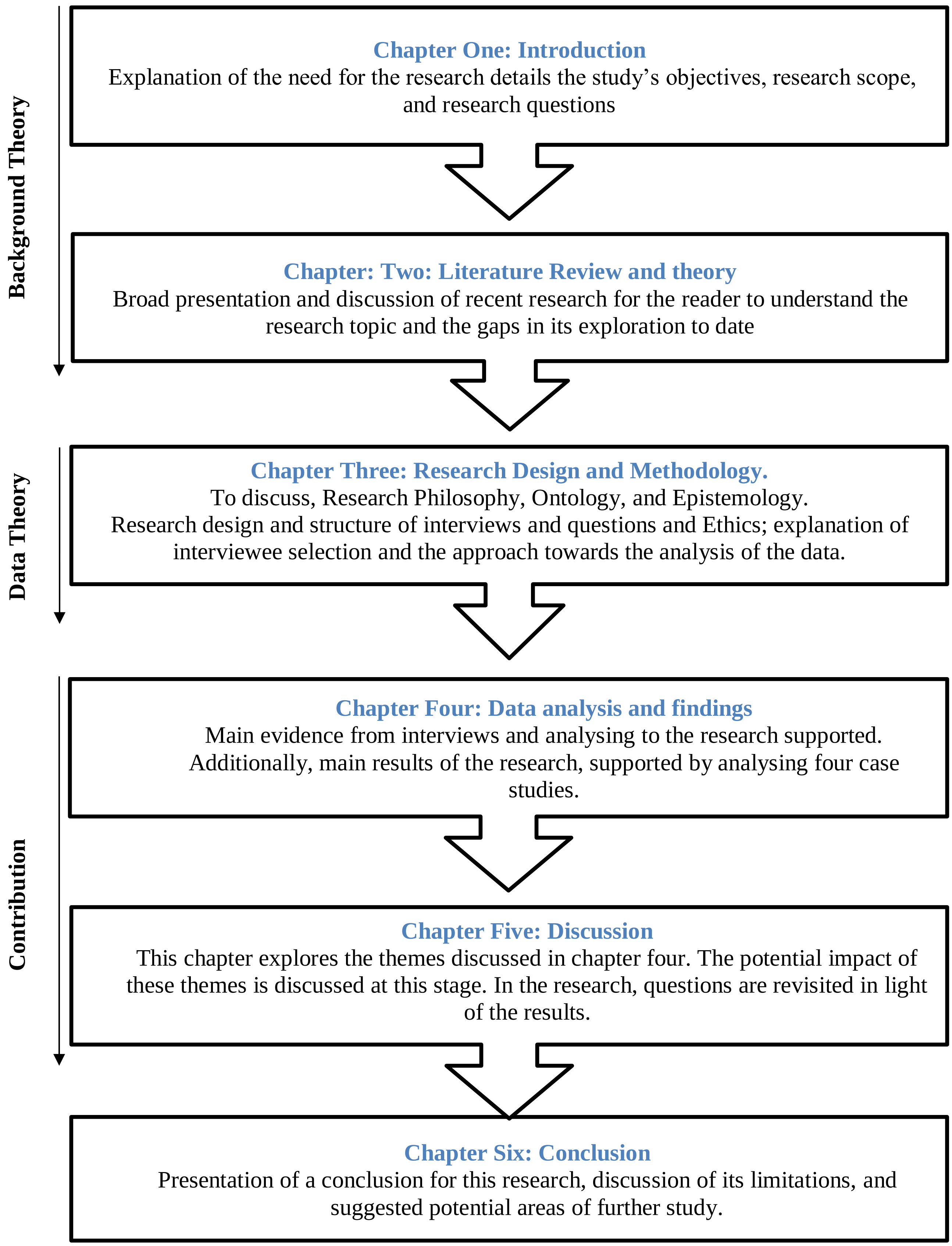
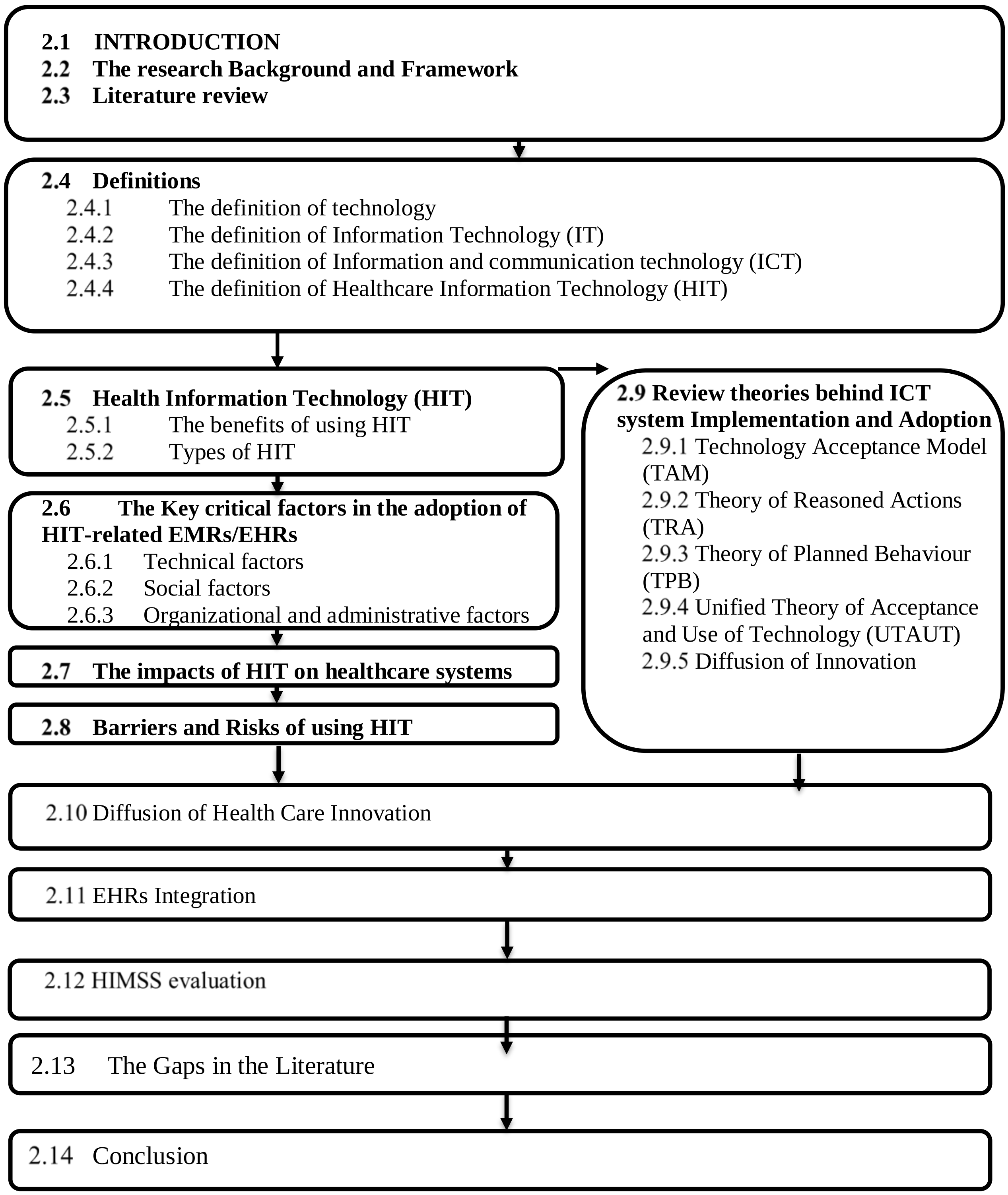


Figure 1-3: The structure of the thesis layout.

Chapter two: Literature review

Figure 2-1: Chapter structure



2.1 Introduction

This chapter is divided into seven main sections, with two goals. The first goal is to establish the current knowledge level regarding HIT and to identify gaps in its understanding. The second goal is to define what theories and constructs could be leveraged to address these gaps and answer the study's research questions. The first section defines the concepts of technology, Information Technology (IT), Information and Communication Technology (ICT), and Healthcare Information Technology (HIT). The second section provides an overview of the Saudi Arabian health care system. The third section offers background information regarding HIT. The fourth section goes into greater detail on the impacts of HIT on health care systems. The fifth section discusses the critical factors that influence the adoption of HIT. The sixth section illustrates the main barriers and issues faced during the adoption of HIT. Finally, section seven discusses in detail the main theories concerning HIT adoption examined by previous studies. This chapter then concludes with a summary highlighting the main points discussed thus far.

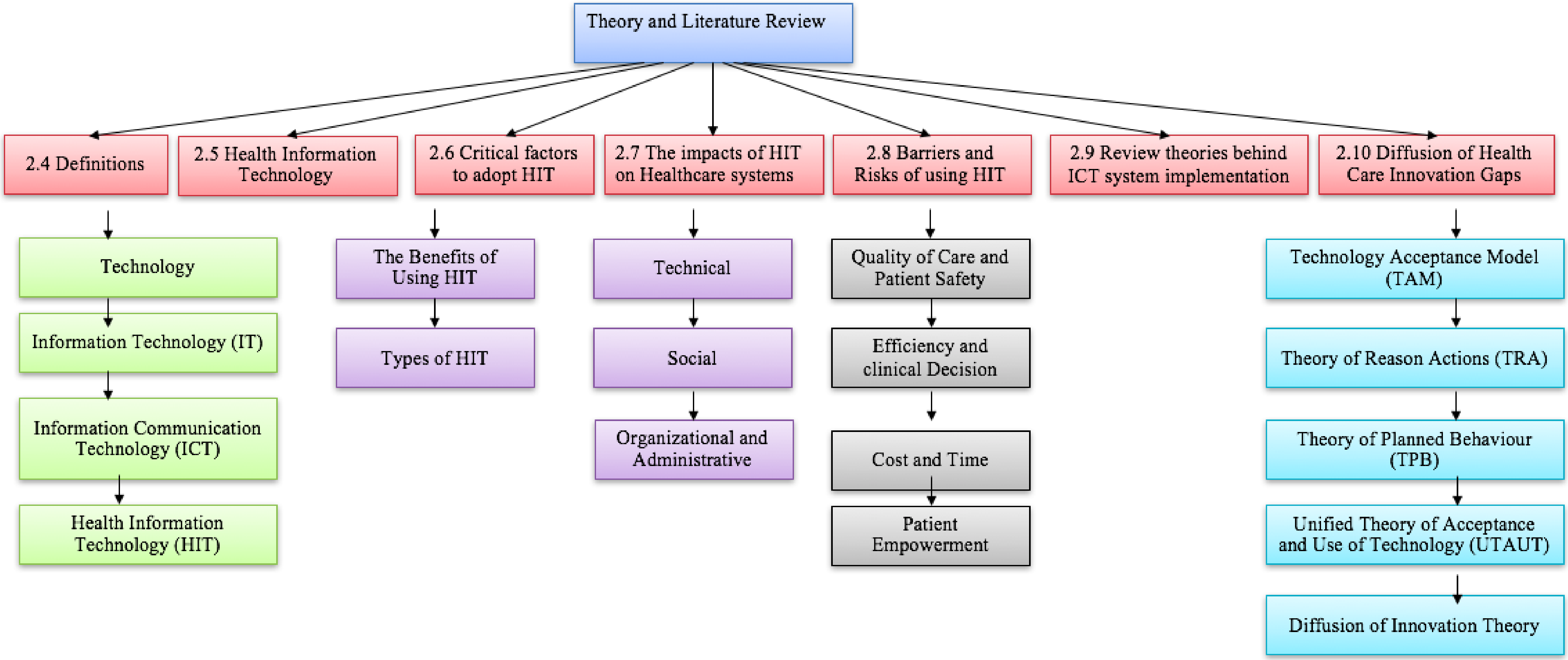


Figure 2-2: The literature review structure

2.2 The Research Background and Framework

Since the 1980s, information technology has revolutionised virtually every facet of our lives. Organizations of all types have long seen that information technology, viewed comprehensively and deployed effectively, has the potential to replace old challenges with new opportunities. However, one area that has been slow to evolve with the use of information technology is the healthcare system. In a broad range of contemporary health care practices, as in organisations, information is both an asset and a challenge for healthcare providers. New information about diseases and treatments can save lives, but a lack of effectively managed data can weaken the advantages of such information. The increased mobility of populations makes it difficult to transfer medical records between different points of care. Adding to this complexity, most patients are not cared for by just a single physician but by a collective process, which includes nurses, consultation specialists, diagnostic technicians, and administrative staff. In addition, at a time when the collective populations of many countries are ageing, chronic disease management can increase the burden on such healthcare systems.

Healthcare in Saudi Arabia, in particular, has been significantly improving in recent times. This has been accompanied by advancements in the field of Information Technology (IT), and more specifically Health Information Technology (HIT). Thus, the application of HIT has been necessary for hospitals in order to achieve objectives such as enhancing the quality of healthcare provided and reducing the time and the cost of healthcare delivery.

The research introduces a research model, which will objectively analyse the impact of the HIT. The initial research phase focuses on the development of metrics that can be used to assess the impact of HIT using both economic and social measures of technology within a healthcare environment. In particular, the situation-surrounding HIT in one country, Saudi Arabia, is examined. This chapter aims to review the theoretical environment pertinent to this research and to provide a comprehensive, critical analysis of existing literature.

2.3 Literature review

Traditionally, a critical approach has been technique for presenting a literature review within management science. A traditional review aims to demonstrate that the writer has extensively researched the literature and critically evaluated its quality. It goes beyond a mere description of identified articles and includes a degree of analysis and conceptual innovation. An effective critical review presents analyses, and synthesises material from diverse sources. The resulting model may constitute a synthesis of existing models or schools of thought, or it may be a whole new interpretation of the existing data (Grant and Booth, 2009). According to Boaz *et al.* (2002), the main purpose a critical review is to give a comprehensive overview of the literature in a chosen area, to identify gaps in existing research, and to develop a conceptual framework to refine a research topic/question (Boaz *et al.*, 2002). In addition, the literature review earns the adjective "systematic" if it is based on a formulated question, identifies relevant studies, appraises their quality, and summaries the evidence by using a specific methodology. According to Jesson *et al.* (2011), there are two techniques for conducting a literature review: traditional and systematic.

A systematic review is defined as “a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyse and summarise the results of the included studies” (Ten Ham-Baloyi and Jordan, 2016, p. 122). The traditional technique reviews the literature to support the research questions and searches for gaps in the literature (Cipriani and Geddes, 2003; Jesson *et al.*, 2011). This study seeks to use the traditional review technique in presenting the literature review because of examining the corpus of theory that has accumulated regarding an issue, concept, theory, and phenomena. Additionally, it helps to establish what theories already exist, the relationships between them, to what degree the existing theories have been investigated, and to develop new themes to be tested.

The research process commenced with a traditional review of the literature on HIT, examining the theories behind ICT system implementation and adoption and related healthcare sectors within Saudi private and public hospitals. The review was guided by the researcher’s knowledge of the topic at the time and by the recommendations of the principal supervisors. All publications regarding healthcare by the government of Saudi Arabia, and the country’s Ministry of Health (MOH) were also critical sources.

This study presented traditional critical evaluation reviews from deferential scientific sources. The ‘critical’ component of this type of review is key to its value. A critical review provides an opportunity to ‘take stock’ and evaluate what is of value among the pre-existing body of work. It may also attempt to resolve competing schools of thought. As such, it may provide a ‘launch pad’ for a new phase of conceptual development and subsequent testing.

2.4 Definitions

2.4.1 The definition of technology

Technology is a general term that refers to the use and knowledge of tools and skills, and the implementation of such skills, which thereby affects our ability to control and adjust to social and physical environments (Banta, 2009). Banta, Kazem, and Robert contend that technology itself originates from the Greek word *techno*, meaning ‘every art’, the ability to perfect what seems imperfect (Chaharbaghi and Willis, 2000). However, Daft and Macintosh (1977) define technology as “the basic task of the organization, subunit technologies, and the tools and techniques associated with individual job technologies, it also could be work-flow or the tools, equipment, and work-related tasks within an organization, used to frame form inputs into outputs” (Daft and Macintosh, 1977, p.82). Viewed differently, Orlikowski (1992) defined technology as ‘hardware’, that is, the equipment, machines, and instruments that humans use in a productive activity, both industrial and informational.

However, technology is not only “hardware” but also “software”. According to Epp (2001), software is the instruction executed by a computer, as opposed to the physical device on which such software runs. In other words, software is a general term for the various kinds of programs used to operate computers and related hardware devices.

2.4.2 The definition of Information Technology (IT)

The concept of IT refers to both hardware and software computer systems across all forms of application, information, and systems of work. IT includes general information, human knowledge, equipment, as well as systems to process information. According to Daft and Macintosh, IT is “the use of hardware and software to manage and manipulate data and information [and] consists of devices that input process, an output data, and information” (Daft and Macintosh, 1977, p.84). In information technology theory, both Aksoy and Denardis (2007) describe IT as a system of hardware and software that processes, exchanges, stores, and presents information, using electrical, magnetic, and electrometric energy (Aksoy and Denardis, 2007, p.8). In summary, IT combines two elements: information, and technology. The information component comes from data and text, which are either separated or combined to give meaning and/or help explain life phenomena, while technology refers to the equipment, tools, and systems of work. When these are combined systematically, they become known as IT.

2.4.3 The definition of Information and communication technology (ICT)

Information and communication technology (ICT) is defined by Razani (2012) as an umbrella term that includes any communication device or application such as radio, television, cellular phones, computers, network hardware and software, and satellite systems, as well as various services and applications associated with these devices. According to the World Bank Group in April 2002, ICT consists of the hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of various forms of voice, data, text, or image information (Trade and Development, 2003).

2.4.4 The definition of Healthcare Information Technology (HIT)

HIT has been defined in various ways, described as a method of managing health information, as a mechanism to improve patient care, or as a process that enables patient care coordination. According to Ciampa and Revels (2013), HIT is defined as "the use of hardware and software in an effort to manage and manipulate health data and information" (Ciampa and Revels, 2013, p.4). Additionally, Davis and Lacour define HIT as "the speciality in the field of health information management that focuses on the day-to-day activities of health information management which supports the collection, storage, retrieval, and reporting of health information" (Davis and Lacour, 2014, p.10).

2.5 Health Information Technology (HIT)

IT provides distinct advantages for the operation of healthcare systems. Ciampa and Revels introduce HIT as the area of IT involving the design, development, creation, use, and maintenance of information systems for the healthcare industry. Automated and interoperable healthcare information systems are expected to lower costs, improve efficiency, and reduce error, while also providing better consumer care and service (Ciampa and Revels, 2013).

Patient electronic health records (EHR) are a central component of the HIT infrastructure. An EHR is an individual's official, digital health record, and can be shared across multiple facilities and agencies. Other essential elements of HIT infrastructure include: The Electronic Medical Record (EMR), which is an individual's health record within a specific healthcare facility; the Personal Health Record (PHR), which is an individual's self-maintained health record; and the Regional Health Information Organization (RHIO), which oversees communications among all other elements and which unifies them, geographically.

In utilising HIT systems, it is critical that a standardised approach is used. One such method has been developed for medical devices in the form of technology assessment. Technology assessment arose in the mid-1960s as a result of the critical role that technology was beginning to play in modern society, and its potential for unintended and sometimes harmful consequences. Health technology assessment considers the effectiveness, appropriateness, and cost of technologies.

2.5.1 The benefits of using HIT

There are several healthcare advantages of using a HIT. According to Ciampa and Revels (2013), the cost of healthcare has been dramatically increasing in recent times. They state that using HIT can both improve healthcare and reduce its cost. Using Electronic Medical Records (EMRs), for example, can eliminate the use of transcription, reducing the need to retrieve patient's charts or files physically, thus reducing the number of duplicated diagnostic tests (Ciampa and Revels, 2013). Similarly, Behkami and Daim (2012) agree that Electronic Medical Records (EMRs) reduce health care costs and also improve health care quality, by preventing medical errors, increasing administrative efficiency, decreasing paperwork, and expanding access to affordable care. The most significant benefits of using HIT include the early detection of infectious disease outbreaks, and the improved tracking of chronic disease (Behkami and Daim, 2012). Also, Aldosari (2014) indicates that HIT has positive effects such as the improved efficiency and effectiveness of care, the reduction of error rates, and the reduction of healthcare costs.

Therefore, the importance of EMRs/EHRs in improving the management of healthcare have led to a development of research interest regarding the rates and levels of adoption of these systems and the determinants of these rates. A literature review by Buntin et al. (2011) shows that HIT provides benefits in the form of lower costs, better quality of care, and improved patient outcomes. This review of the recent literature on the effects of health information technology is of interest, as it suggests that the expansion of health IT into the healthcare system is worthwhile.

2.5.2 Types of HIT

Healthcare systems often involve a variety of definitions and applications in academic literature, with a range of terms used. A study by Furukawa *et al.* (2008) shows that healthcare information technology includes Electronic Medical Records (EMR) and Computerized Physician Order Entry (CPOE). Additionally, further studies have mentioned other applications such as Personal Health Records (PHRs), E-prescribing, Electronic Dental Records (EDR), and Electronic Patient Records (EPRs). It is important to note that while these terms might be used interchangeably, there are slight differences within each system. Their primary applications in HIT will be discussed below.

*2.5.2.1 **Electronic Medical Records/Electronic Health Records (EMRs/EHRs)***

Research by Horowitz *et al.* (2008) describe Electronic Medical Records (EMRs) as "an electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorised clinicians and staff within one healthcare organisation" (Horowitz *et al.*, 2008, p.16). In addition, EMRs have advantages over paper records. For instance, EMRs allow clinicians to track data over time, easily identify which patients are due for preventive screenings, check how their patients are doing on certain parameters such as blood pressure readings or vaccinations, and monitor and improve the overall quality of care within the practice (Seidman and Oshua, 2011).

In contrast, Electronic Health Records (EHRs) are "an electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one healthcare organization" (Horowitz *et al.*, 2008, p 17).

*2.5.2.2 **Differences between EHRs and EMRs***

Several differences exist between electronic health records (EHRs) and electronic medical records. The terms EHR and EMR have been mistakenly used interchangeably (Lian *et al.*, 2012); however, the two have differences that must be clarified (Katz, 2015). EMRs emerged first and are used by clinicians for medical purposes, such as diagnosis and treatment (Sparks, 2017). EHRs emerged much later to cover a broader territory in health than the EMRs (Anoshiravani *et al.*, 2012). According to Duckworth (2014), EMRs are a digital version of paper charts in the office of the clinicians. They contain both the medical and treatment history of individual patients in a particular practice (Ajami and Arab-Chadegani, 2013a). As an alternative, EMRs have more advantages over paper records. The key advantages include the ability to track data over time and allow clinicians the ability to easily check patients' progress using various parameters, such as blood pressure readings (Sitonik, 2017). EMRs help clinicians to point out patients that are in need of preventive screening or check-ups (Razmak, 2016). However, EMRs do not allow an easy flow of health information from one health practice to another within the health organisation (Al Aswad, 2015). It is for this particular reason that EMRs can be said to be disadvantageous in relation to paper records.

On the other hand, EHRs cover the health of individual patients in totality by going beyond standard clinical data obtained in the care providers' office to include a broader view regarding the patient's care (Khorma, 2012). EHRs are designed to be used beyond the health organisations that initially collected and compiled the medical information (Khorma, 2012). Unlike EMRs, where sharing information from one point of practice to the other is difficult, with EHRs, information is easily shared from one place to another (Mugambi, 2015). The nature of EHRs allows all healthcare stakeholders to access the right information whenever there is a need (Bonewit-West, 2017). With fully functional EHRs in place, information from the primary care provider is moved with the patient so that decision-making is guided by the prior health information (Iyinbor, 2014). EHRs allow patients to check their health information by logging into their respective health portals (Kollman *et al.*, 2016).

EHRS	EMRs
Digital record of health data.	Digital version of paper charts.
Owned by patient or stakeholder.	Owned by the care-delivery organisation.
Contains relevant material that a care provider can use in decision-making.	Contain information that can only be used by care provider to make diagnosis and treatment.
Allows streamlined and timely sharing of up-to-date information	Does not allow sharing of information outside one practice
Subset of information from various care-delivery organisations where patient has had encounters.	The legal record of the care delivery organisation.
Sold by enterprise vendors and installed by hospitals, health systems, clinics, etc.	Community, state, or regional emergency or nationwide in the future.
Provides interactive patient access as well as the ability for the patient to append information.	May provide patient access to some results through a portal but is not interactive.

Table 2-1 The key differences between EHRs and EMRs (Garets and Davis, 2006, p.3).

2.5.2.3 Personal Health Records (PHRs)

According to Kaelber *et al.* (2008), one of the critical challenges in delineating a PHR research agenda is the absence of a consistent description of what a PHR entails. They define PHRs as "a set of computer-based tools that allow people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it" (Kaelber *et al.*, 2008, p.730). They also note that their definition is just one of many PHR descriptions, that such a definition is evolving, and that the future of PHR definitions remains unknown.

Additionally, PHRs allow individual patients to collect, view, manage or share their health information electronically. A broad range of PHR product exists, ranging from online resources, available to the public, to those offered to patients using a specific clinic or healthcare system. PHRs let patients track medical and dental treatments and progress. Furthermore, patients can use such portals to renew prescriptions, receive reminders and health education messages, and schedule appointments. While these systems continue to evolve, at present, only dental notes, and not laboratory results or x-rays, are available (Kaelber *et al.*, 2008).

2.5.2.4 E-prescribing

An international review by the Centre for Medicare and Medicaid Services in the United States defines e-prescribing as "the transmission, using electronic media, of prescription or prescription-related information between a prescriber, dispenser, pharmacy benefit manager, or health plan, either directly or through an intermediary, including an e-prescribing network. E-prescribing includes, but is not limited to, two-way transmissions between the point of care and the dispenser" (Care, 2012, p.5). Medication orders are received and processed electronically thereby eliminate the use of paper in the processing of prescriptions in pharmacies (Odukoya and Chui, 2013).

E-prescribing can also achieve the following: the reduction of medical errors; a decrease in pharmacy costs; the improvement of both prescriber and pharmacy efficiency; the elimination of handwriting interpretation errors; the reduction of phone calls between pharmacists and physicians; the reduction of data entry; and the acceleration of prescription refill request processing. The use of e-prescribing systems has led to an increase in the number of prescriptions being processed by pharmacies (Odukoya and Chui, 2013).

E-prescriptions are generated within e-prescribing systems and are electronically transmitted to pharmacies directly computer-to-computer via a secure network between prescribers and pharmacies (Moniz *et al.*, 2011). E-prescribing allows clinicians and patients to use electronic systems to submit, transfer, and order prescriptions. A provider can enter prescription information into these electronic systems from their home or office computer, which will then be presented to the pharmacy for dispensing and then made available to the patient.

*2.5.2.5 **Computerized Provider (Physician) Order Entry (CPOE)***

There are studies by Khanna and Yen (2014) which suggest that the concept of CPOE has evolved over time but that, in practice, the meaning of CPOE has changed very little. In 2003, researchers at Harvard defined CPOE as "a variety of computer-based systems that share the common features of automating the medication ordering process and that ensure standardised, legible, and complete orders" (Kaushal *et al.*, 2003, p.26). In 2010, the Centre for Medicare and Medicaid Services (CMS) defined CPOE as the provider's use of computer assistance to directly enter medication orders from a computer or mobile device. The order is also documented or captured in a digital, structured, and computable format for use in improving safety and organisation (CMS, 2010).

Both definitions agree on the role of the physician, who enters orders directly through a digital interface, and on the general standardisation/structure of such systems.

In reviews by Leapfrog Group (2007), CPOE systems are described as electronic prescribing systems that intercept errors which most commonly occur at the time medications are ordered. With CPOE, physicians enter orders into a computer rather than on paper. Orders are integrated with patient information, including laboratory and prescription data. They are then automatically checked for potential errors or problems.

A specific benefit of CPOE is that it electronically warns against ordering prescription medication that has the potential for drug interaction, potential allergies or overdoses. Additionally, accurate, current information on new drugs introduced into the market is made available, along with drug-specific information that eliminates confusion among drug names that sound alike. Furthermore, CPOE improves communication between physicians and pharmacists and reduces healthcare costs due to improved efficiency.

*2.5.2.6 **E-health***

E-health is one of the most important and latest Information Communication Technology (ICT) applications in healthcare. Defining e-health is more challenging than defining HIT. The reason behind this is that ICT is a very new and complex field. According to Eysenbach (2001), the "e-word" was first used by industry leaders and marketing people rather than academics. They introduced this term along with others such as e-business, e-commerce, e-government and so on.

Eysenbach (2001) defines e-health as "An emerging field in the intersection of medical informatics, public health, and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology" (Eysenbach 2001, p.23).

Furthermore, e-health can be integrated with strategic health system planning, which improves the health care, based on improved cooperation between health professionals and health technology management (Tan, 2005). E-health is an application within the area of Information Communication Technology (ICT) (Iakovidis *et al.*, 2004; Tan, 2005). Iakovidis *et al.* (2004) state that e-health is an end-to-end process, which means it extends from birth registries to "cause-of-death" registries, from prevention and screenings to follow-ups, from emergency intervention to homecare, whatever the cultural or national context. Additionally, both patients and clinical staff benefit from using different utilisations of e-health. For instance, the patient can use an e-health system when seeking information online, using self-management tools, participating in electronic communities, and requesting a second opinion. From a clinical staff perspective, e-health provides them with better information access such as to schedule patient visits, patient administration, laboratory information, radiology, pharmacy, nursing, and electronic messaging between hospitals and other healthcare providers. Also, e-health has provided better communication between clinical and administrative staff, and patients for the sharing of health data and telemedicine in any speciality (Iakovidis *et al.*, 2004).

2.6 The key critical factors in the adoption of HIT-related EMRs/EHRs

This section focuses on critical factors that influence the adoption of a HIT. These are divided into three main factors, which include technical, social, and organisational and administrative factors. The purpose of this section is to provide a foundation for this study. In light of this study, this critical review aims to provide an overview and extract potentially generalizable findings across adopting and integrating EHRs in both public and private hospitals. Furthermore, the results show that the main technical factors that need to be illustrated can be within the domain of both hardware and software. Moreover, the social factor is explained in this study as for how humans behave with dealing with technology health care and what is needed to improve such connections. Lastly, managing resources such as IT equipment and human resources, while implementing HIT-related EHRs, is one such organisational and administrative factor that must be discussed. Overall, this section provides an overview of the factors influencing the adoption of HIT that is currently addressed by literature on health informatics.

2.6.1 Technical factors

A number of recent interpretative literature reviews have been conducted to identify studies addressing the technical factors that influence the adoption of HIT (Chen *et al.*, 2012; Cresswell and Sheikh, 2013; Lian *et al.*, 2014). The findings of these studies are presented as several sub-factors. Firstly, Lian *et al.* (2014), who introduced the main technical factors related to IT infrastructure, agree that having an advanced IT infrastructure can improve the adoption of technology in healthcare. This also enables the acceptance and development of IT in healthcare, to share data internally and externally. Chen *et al.* (2012) agree with Lian *et al.* (2014) that health organisations need to build and organise their structures to enable IT equipment to adjust.

Secondly, research by Soliman and Janz (2004) points out that data security and privacy are technical concerns when it comes to adopting HIT-related EHRs; this includes all data, such as personal data, laboratory data, radiology data, and diagnostic data. Thirdly, previous studies have also indicated that the complexity and compatibility of IT and IS can affect the adoption of HIT-related EHRs (Boonstra and Broekhuis, 2010; Lin *et al.*, 2012; Liu, 2011). For instance, using multiple systems, such as a picture archiving and communication system (PACS), hospital information system (HIS), and radiological information system (RIS) improves the complexity of using HIT. Additionally, several studies have looked at technical factors, such as computer skills amongst users, obvious limitations of the system, and lack of customizability as resulting in a system that does not meet the requirements of users. Further, technical factors include a lack of reliability (e.g., crashes), interconnectivity issues with existing systems, and a deficiency of hardware able to support EMRs (Boonstra and Broekhuis, 2010). Overall, all studies highlight the issue of technical factors from different viewpoints: factors that are instrumental in the adoption of EHRs and in implementing further HIT applications successfully.

2.6.2 Social factors

Many social factors come into play in the adoption of HIT-related EHRs. Most studies define social factors as human behaviours in relation to dealing with technology. These include, in particular, information technology literacy and general user competency, personal and peer attitudes towards innovation (including patients and health professionals staff), and the on-going involvement of key stakeholders (including management and developers) at the conception and design stages (Keshavjee *et al.*, 2006; Ludwick and Doucette, 2009; Yarbrough and Smith, 2007). Undoubtedly, different users have the differing knowledge and cultural backgrounds, which can affect the implementation of this technology (Cho and Larose, 1999).

According to Thompson *et al.* (1991), social factors are users' behaviours when dealing with IT, which can include users' personal culture, acceptance, motivation to use the system, confidence and self-efficacy, satisfaction, support, data quality, and integrity. Additionally, Kling (2000) defines social informatics as the body of research that examines the design, uses, and consequences of ICT in ways that take into account their interaction within institutional and cultural contexts. Moreover, Keshavjee *et al.* (2006) indicate that relationships and communications are significant social factors influencing the adoption of information technology. Relationships and communications are essential management skills when it comes to supporting and developing HIT projects. Robert *et al.* (2010) believe that the better the communication skills between users and IT developers, the easier the system are adopted and vice versa. This assertion has been confirmed by other researchers, such as Gruber *et al.* (2009), who believe that the sharing of information to improve communication/efficiency and patient care through open communication channels can help to ensure that systems are valued and used properly by professionals and patients. Furthermore, some studies have included the training and development of users as an essential factor influencing the adoption of HIT (Boonstra and Broekhuis, 2010; Cresswell and Sheikh, 2013; Ludwick and Doucette, 2009; Yarbrough and Smith, 2007). According to Cresswell and Sheikh (2013) and Yusof *et al.* (2007), training is part of a wider group of social factors, such as firm leadership, technical support, response time/turnaround time, information accessibility, information relevance, clarity of system purpose, user involvement, user training, user perception, user skills/knowledge, user roles, clinical process, champion/medical sponsorship, and internal communication.

These are some of the social factors that have been critically reviewed and are considered to be inter-related in relation to HIT adoption. However, there are differences between social, organizational, and administrative factors, which will be discussed.

2.6.3 Organizational and administrative factors

To date, some studies have focused on an examination of the organisational and administrative factors related to HIT. Indeed, several studies have listed specific organisational and managerial factors, which will be considered (Gagnon *et al.*, 2010; Keshavjee *et al.*, 2006; Ludwick and Doucette, 2009; Yarbrough and Smith, 2007). Firstly, studies have shown that health managers adopt the electronic health system application because of its ability to reduce workloads and because it helps mitigate the risk of unintended consequences. According to Kuan and Chau (2001), changing government policy can also affect management strategies and decision-making, which in turn influence IT strategic planning. However, some government policies have encouraged people in health organisations to use HIT. Moreover, it is essential to have public policy standards that similar can be utilised between private and public hospitals.

The study of Cresswell and Sheikh (2013) indicates that management structures can be essentially restructured to accept this technology. Consequently, it facilitates the redesign of workflows and the provision of adequate training and support to users and highlights problematic issues (Gagnon *et al.*, 2010). Furthermore, organisational leadership and management are responsible for ensuring redesigned workflows by the adoption of electronic health system applications. It is necessary to re-engineer workflows to adopt the system and to organize them in order to be able to use the system to its full potential. The study of Yusof *et al.* (2008) agrees that strong organisational leadership and management are necessary to ensure strategic consistency.

Additionally, the work of Keshavjee *et al.* (2006) explores critical management stages and strategic IT requirements which should precede the implementation stage of HIT. This begins with an investment in implementation from top management, which includes the establishment of a vision and organisational mission, and the allocation of resources. This stage should involve effective planning and communication, conflict resolution, the participation of stakeholders, and the motivation of users. It is essential that an analysis step be introduced to address user concerns and needs; communication with all users is essential in order to know how new technology solutions can address and fit in with such needs. It is essential to understand that changing from traditional paperwork to IT is difficult, but it can overcome barriers. Keshavjee *et al.* (2006) also explore the integration between different systems; their view is that if the system integrates effectively with existing systems, it is then necessary to determine how paper records will be entered on said system, as well as addressing issues surrounding standardisation. Additionally, usability needs to be taken into consideration for both hardware and software, which also needs to fit in with existing work processes. For instance, EHR systems are often complex, resulting in reduced usability; this dictates the need for extra time to do some actions and involves intense learning on the part of the user. Thus, usability can be improved by adopting some flexible technology, such as tablet and smart phone.

In summary, to understand how to adopt HIT successfully, there are three main factors that influence the use of IT in the healthcare industry. These key factors are presented in the following table.

Critical factors to adopt HIT	Types of impacts	References
Technical factors	IT infrastructure	Lian *et al.* (2014) and Chen *et al.* (2012)
	Data security and privacy	Soliman and Janz (2004)
	IT and IS complexity and compatibility level.	(Boonstra and Broekhuis, 2010; Lin *et al.*, 2012; Liu, 2011).
	Computer skills amongst users Lack reliability (e.g., crashes), interconnectivity with existing systems, and customisability resulting in a system.	(Boonstra and Broekhuis, 2010).
Social factors	Knowledge and cultural backgrounds.	Thompson *et al.* (1991) and (Cho and Larose, 1999)
	User's behaviours included users' subjective culture, acceptance, motivation to use the system, confidence and self-efficacy, satisfaction, support, data quality and integrity.	Thompson *et al.* (1991)
	Relationship and communications	Keshavjee *et al.* (2006) Robert *et al.* (2010)
	Training and development	(Boonstra and Broekhuis, 2010; Cresswell and Sheikh, 2013; Ludwick and Doucette, 2009; Yarbrough and Smith, 2007)
Organizational and administrative factors	Government policy	Kuan and Chau (2001)
	Management structure including a redesign of workflows.	Cresswell and Sheikh (2013) (Gagnon *et al.*, 2010)
	Organizational leadership and management ensure strategic consistency.	Yusof *et al.* (2008)
	IT strategic	Keshavjee *et al.* (2006)

Table 2-2: The key critical factors to adopt HIT

2.7 The impacts of HIT on healthcare systems

It is important to highlight the definition of 'impact', which can be defined as "The action of one object coming forcibly into contact with another, [or, used] as a verb (impact on), [to] have a strong effect on someone or something" (Ciampa and Revels, 2013, p.4). Indeed, this "effect on someone".

There are several studies have looked at the impact of HIT on health care systems, with different views. Most of the studies in question look at impacts, which are seen as either internal or external. The key impacts of HIT-related EHRs/EMRs on health care are based on the healthcare delivery process, people working within the organisation, patients and relationships with stakeholders (Brynjolfsson and Yang, 1996). According to Brynjolfsson and Yang (1996), economic evaluation is one way of gauging the impact of health information technology, by comparing projected incomes and costs; for instance, by contemplating the investment made in parallel with the economic advantages achieved. However, this process of estimating the value of ICT is unreliable, since it does not take several factors into account, such as the strategic improvement in efficiency, as well as improvements in company performance, higher quality of processes, and increased value in healthcare. It will be explored in the following section, examining the impacts of HIT on health care. Following this, the main impact of HIT on health care systems will be discussed.

2.7.1 The impacts on quality of care and patient safety

Most researchers have highlighted that the adoption of EMRs/EHRs enables improvements in patient safety by avoiding a lot of errors in drug prescriptions (Abdelhak *et al.*, 2014; Bates *et al.*, 1999). According to Cannon and Allen (2000), using EMRs/EHRs makes it possible to provide clinical staff with automatically generated alarms, alerts, and reminders, which have a positive effect on the quality of patient care. Laing (2002) observed that nurses find EMRs/EHRs improve standardised nursing language, and health data reports, providing an easy to use and extensively integrated health database.

However, the study by Likourezos *et al.* (2004) finds that users of EMRs in an Accident and Emergency Ward state that EMRs have an adverse impact on patient care because the system may lead to some confusion and may require more time. This being said, in physicians' literature, such as in the study of Chaudhry *et al.* (2006), it is often stated that the impact of HIT on the quality of healthcare has been comprehensively examined and that average quality was higher for hospitals with electronic health records and computerised physician order entry. The major impact of HIT on quality of care is its role in increasing adherence to guidelines or protocol-based care. Additionally, the study of Chaudhry *et al.* (2006) shows that HIT improves the quality of care through clinical monitoring, involving large-scale screenings and aggregation of data. Additionally, health information technology has positive effects on quality through a reduction in medication errors.

2.7.2 The impacts on efficiency and clinical decision-making

When it comes to the impact of HIT on the efficiency of healthcare, Chaudhry *et al.* (2006) argue that it contributes to the efficiency of care and the time taken to provide it. Tierney *et al.* (1990) have shown decreased rates of health-service utilisation, as computerised order-entry systems are providing decision support at the point of care when the primary interventions are taking place. Wong *et al.* (2003) and Pierpont and Thilgen (1995) discovered slight decreases in documentation-related nursing time due to the streamlining of the workflow. However, the studies of Tierney *et al.* (1993) and Overhage *et al.* (2001), at the Registries Institute, examining inpatient order entry, show increases in physician time related to computer use. Another study by Pizziferri *et al.* (2005) shows that using EHRs allows the outpatients to reduce the waiting time but does not reduce the actual clinic treatment time.

As mentioned above, the adoption of EMRs can facilitate the decision-making process for clinical and administrative staff. Studies such as those conducted by Neame and Olson (1997) have shown that there is a need to share clinical information in order to develop the safety, continuity, integrity, and delivery speed of patient care. According to Laing (2002), the development of EMRs supports the more widespread use of clinical data exchange. Thus, data becomes easier and faster to analyse, allowing decision-making to become quick and easy. There is no doubt about the significance of web technology as a primary factor in the improvement of communications and as an enhanced alternative to the electronic messaging environment, which by extension facilitates decision-making.

2.7.3 The impacts on time and cost saving

The most positive impact of health information technology (HIT) related EMRs on healthcare organisations is time and cost saving. According to Van Der Loo *et al.* (1995), using EMRs can make collecting data less time to consume and less difficult than via traditional means. Additionally, Thompson *et al.* (2009) agree that by using EMRs, patient health information can be shared more quickly. As a result, sharing patients' health information by EMRs can reduce geographical barriers, as well as allowing for health record integration, particularly in fragmented health systems, thus improving the continuity of care (Pagliari *et al.*, 2007). Most researchers agree that using EMRs leads to potential cost savings via a decrease in unnecessary prescriptions or repeat testing. The study of Joos *et al.* (2006) shows the time-saving measures for the diagnosis of a patient through using EMRs. Also, a study by Keshavjee *et al.* (2001) concentrates on the success of implementing an EMR, based on the analysis of two different time periods: six months, and eighteen months after the adoption of an EMR. The results found, at the time, that the need for administration decreased within the six-month period; however, the time spent by clinic staff on charting improved during the first six months, but then returned to its original level later. Additionally, research was carried out by Likourezos et al. (2004), which found that clinic staff were able to finish tasks much faster than before when using EMRs; this result was not shown by clinicians, who added less repetitive activities.

Leaders in healthcare organisations indicate that improving and changes in the utilisation of EHRs services are significantly impacting on the cost of adoption HIT (Chaudhry *et al.*, 2006). A study by Wang *et al.* (2003) found that the most significant impact of HIT on cost concerned aspects of system implementation or maintenance.

However, Mcdonald, (1976) and Wilson *et al.*, (1982) stated that main impact of cost is providing computer storage data; these statements were more than 20 years old, however, nowadays there is no impact on the cost of computer storage data and therefore were of limited relevance. Moreover, Teich *et al.* (2000) report that system maintenance has high cost. The reason behind this is that these systems were built, implemented, and evaluated incrementally over time, and in some cases, were supported by research grants. It is unlikely that total development and implementation costs could be calculated accurately and in full detail.

2.7.4 The impact on patient empowerment

Many authors have investigated a variety of effects related to patient empowerment. The studies of Tsai and Starren (2001), for example, found that patients who are connected with EMRs have a reduced total number of clinical visits and better healthcare outcomes. Furthermore, studies by Chin and Mcclure (1995) and Wright *et al.* (1997) state that communication technologies provide a better approach to link patients and supply a higher quality of care. Additionally, Littlejohns *et al.* (2003) were able to use an evaluation programme to explain that EMRs can develop the accessibility of patient related information. Most researchers agree that developing and managing medical records has positive effects on patient administration procedures; as a result, waiting times are reduced, and a better quality of service is provided. There is no doubt that this improves the efficiency of hospital management, as well as improving accurate decision-making and productivity. However, some writers, including Essin *et al.* (1998), have argued that EMR system does not affect the interaction between clinicians and patients.

According to Norris and Moon (2005), the impacts on organisational outputs and outcomes can be concentrated on efficacy, productivity, and effectiveness. It is very difficult to measure return on investment when it comes to health information technology, especially in the economic field. Looking for examples, the studies of Kraemer and Dedrick (1997) have emphatically stated that there is a positive relationship between the use of IT and productivity. The clinical governance point views the adoption of EMRs could improve and support clinical decisions making. This agrees with both Smith (1996), Kelly (1998) and Goodman (2000), who found that sharing clinical information supports the continuity, integrity, and speed of decision making in patient care.

To summarise, many authors have explained the different benefits of EMR implementation without practical evidence (Øvretveit *et al.*, 2007). However, this research will be contributed to the impact of HIT-related to EHRs/EMRs in practical evidence using four cases studied. The reason most authors found describing the impact difficultly of EMRs because of the complexity of the area. The following table illustrates the key findings from studies related to EMR.

Division of the EMRs impacts	Types of impacts	References
IMPACTS ON THE HEALTH CARE DELIVERY PROCESS	Improve writing prescription	(Eslami *et al.*, 2009), (Care, 2012),(Odukoya and Chui, 2013), and(Moniz *et al.*, 2011)
	Improve x-ray Images transfer	(Maass and Suomi, 2004)
	Improve sending reports	(Pushkin *et al.*, 2010; Vigoda *et al.*, 2006)
	The Time waiting for results	(Thompson *et al.*, 2009), (Pagliari, 2007), (Joos *et al.*, 2006), and(Likourezos *et al.*, 2004)
	Cost saving	(Wang *et al.*, 2003), (Mcdonald, 1976), and (Wilson et al., 1982)
	Process integration	(Pagliari, 2007), and (Thompson *et al.*, 2009)
	Completeness	(Shachak and Reis, 2009), and (Jamal et al., 2009)
	Care process	(Abdelhak *et al.*, 2014), and (Delone and Mclean, 2003)
IMPACTS ON USERS WORKING WITHIN HEALTHCARE ORGANIZATION	Improve clinical decision-making	(Abdelhak *et al.*, 2014; Bates *et al.*, 1999),(Neame and Olson, 1997), and (Laing, 2002)
	Reduce Transcription errors	(Bates *et al.*, 1999)
	Improve decision process such as statistic numbers	(Hadler, 2005) and (Balas and Boren, 2000)
	Patient care quality and safety	(Kaplan and Lundsgaarde, 1996),(Neame and Olson, 1997), (Cannon and Allen, 2000), and (Omachonu and Einspruch, 2010)
	Develop communication between all clinical staff	(Cooke and Peterson, 1998) and (Joos *et al.*, 2006)
	Improve organizing clinical staff's duties	(Saarinen and Aho, 2005)
	Improve education for staffs	(Saarinen and Aho, 2005)
	Improve the medical record backup	(Darbyshire, 1999) and (Gustafson and Wyatt, 2004)
	Training Time for using EMRs	(Kovner et al., 1996)
IMPACTS ON PATIENTS	Patient safety	(Abdelhak *et al.*, 2014), (Bates *et al.*, 1999), (Laing, 2002), and (Likourezos *et al.*, 2004)
	Patient empowerment	(Laing, 2002) and (Likourezos *et al.*, 2004)
	Documenting patient's health record and secure data	(Jamal *et al.*, 2009; Thompson *et al.*, 2009)
	Patients integrated with physician	(Essin *et al.*, 1998), (Makoul *et al.*, 2001), and (Wager *et al.*, 2000)
	Feedback from patients about health care performance	(Simon *et al.*, 2007)
IMPACTS ON RELATIONSHIP WITH OTHER STAKEHOLDERS	Information sharing with private's hospital and public hospitals	(Porteous *et al.*, 2003)
	Improved communication with different hospitals	(Doolan *et al.*, 2003) and (Gadd and Penrod, 2001)
	Control the demand	(Bates *et al.*, 2003)

Table 2-3 Summary the key findings of the impacts

2.8 Barriers and Risks of using HIT

Computerisation brought with it a significant number of advantages. It provided a better way of handling information, sharing it, and improved communications. Computers, given their efficiency, have reduced the degree of inaccuracy in data analysis and mathematical computations, just to name a few of its merits. More accurately, systems have been developed to solve different problems that hinder the efficiency of people's actions or activities and to optimise the processing of information. One of the key differences between developed and developing countries in this information age is how information is utilised (Ajami and Amini, 2013a; Ajami and Amini, 2013b; Ajami and Arab-Chadegani, 2013a; Ajami and Arab-Chadegani, 2013b; Ajami and Bagheri-Tadi, 2013). In the health sector, the major problem of safely and economically storing and managing patients' information can be significantly reduced by Health Information Technology implementation and by the adoption of Electronic Health systems in health facilities.

HIT Systems, improves the quality of the service that patients receive, provides more access to care for the patients, and even promises to save on the hospital's expenses. However, against these advantages, some disadvantages surface in the debates and conversations surrounding HIT. Although the perceived merits of a HIT are often discussed by many proponents, what is never present in the discussion are the honest and actual experiences of practitioners who use HIT systems (Herrick *et al.*, 2010). Besides having health facilities that are well implemented and structured, which have all the necessary HIT systems installed, a higher priority needs to be given to the quality of the premises, service efficiency, and patient's convenience.

Most of the barriers to HIT and Electronic Health Records are either cost related, due to limitations in IT infrastructure, limitations by standards, the attitude of the health practitioners, or organisational (Ajami and Arab-Chadegani, 2013a). More and more researchers are becoming interested in what influence HIT has and how efficiently they operate. The Health Financial Management Association (HFMA) in 2006 conducted a study. Senior healthcare finance executives in different hospitals were surveyed, as were those in health systems of various sizes and regions. They sought to understand the different views of financial executives regarding EHRs adoption barriers and what actions governments could implement that could increase adoption rates. From the 176 responses they got, the hospital functions that were highly reported to have progressed significantly were electronic information or data capture (23 percent), results in management (27 percent), and order entry (38 percent). The lack of interoperability (50 percent), little concern about the physician (51 percent), lack of available funding (59 percent), and lack of national information standards, and code sets (62 percent) were significant key barriers (Healthcare Financial Management Association, 2006).

The Medical Records Institute (MRI) has comprehensively studied the trends and usage of EHR systems annually in recent years, with experts in the Health and information fields agreeing that HIT is necessary. The findings of the 2005 survey were derived from 280 respondents practising in the hospital, ambulatory, IHDSOs, among other environments. The more significant part of the responses was from information technology (IT) professionals/managers (42 percent), which included Network Managers, CIOs, MIS Managers, Health Information Managers, and Medical Information Systems Professionals, among others.

Most of the respondents interacted mostly with those with an administrative and financial background; dealing with e-mail tasks; and data analysis, review and update IT tools. They were tasked with marking the motivating factors that drive the implementation of EHR systems. The highest marked factors were: to improve clinical work process efficiency; to improve care quality given to patients; to enable easy and quick sharing of medical data among healthcare practitioners /professionals and to bring medical errors to a minimum. Lack of funding or resources was a major HIT implementation barrier marked by the majority of the respondents (57 percent) (Thakkar and Davis, 2006).

The American Health Information Management Association, in collaboration with Health Informatics, conducted a study in 2004 to measure how ready professionals in Health Information Management (HIM) were, and the level at which their organisations have implemented EHRs. More organisations are seen to be moving towards EHRs according to the findings of the study. When the organizations were, for instance, asked to describe their progress towards EHRs, those that had extensively implemented them were 17 percent; partially implemented were 26 percent; 27 percent were either in the selection process, planning for the implementation or had minimally implemented; while those considering implementation and doing research on EHRs were 21 percent (Zender, 2005).

The American Academy of Family Physicians, in summer 2004, also conducted a study. In their results, of those with AAFP membership, nearly 40 percent claimed that either they were in the process of implementing EHRs or they already had implemented one. Within the first half of the year, 24 percent of them had already purchased the EHRs system.

Similarly, the findings showed that the physician's operating or working in medium and small practices main issue in the adoption of EHRs was the cost (Carol, 2005). Privacy and security were identified as the key risks and significant concerns with the implementation of EHRs (Bates, 2005; Hersh, 2004; Sprague, 2004).

Privacy is defined as "control over when and by whom the various parts of us can be sensed by others" (Parker, 1973, p.281). According to Gavison (1980), it is "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others" (Gavison, 1980, p.427). This is confirmed by Porambage et al. (2016), who state that information privacy is the capacity of an individual or group to prevent information about themselves from becoming known by other people. Furthermore, privacy is used in a variety of ways. In the case of healthcare data privacy, for example, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) interprets privacy in healthcare as a person's right to safeguard patient health information from being disclosed without authorization. Health data privacy involves information and processes that control who is authorized to access patient health information and under what conditions or policies patient information may be accessed, gathered, or disclosed to a third party. According to Westin (2006), increased attention is being paid to privacy, especially by online users, regarding how their personal health information is used, protected, disclosed, and the degree of control they have over the dissemination of this information. Finn et al. (2013) present seven different types of privacy, comprising: privacy of the person; privacy of behaviour and action; privacy of communication; privacy of data and image; privacy of thoughts and feelings; privacy of location and space; and lastly, privacy of association.

Information security is defined as “the need to protect information resources and prevent unauthorized access to organization” (Katsikas, 2006, p.531). The HIPAA explains information security as the mechanism in place to protect the privacy of health information. This includes the ability to control access to patient information, as well as to safeguard patient information from unauthorized disclosure, alteration, loss, or destruction. Additionally, the HIPAA define security as typically being accomplished through operational and technical controls. According to Finn *et al.* (2013), there are seven types of security, namely: physical security, political security, socio-economic security, cultural security, environmental security, radical uncertainty security, and information security.

There are differences between privacy and security, which need to be discussed (Herold, 2002; Jain et al., 2016; Parker, 1973; Ware, 1967). Privacy, as current legislation for many countries such as Saudi Arabia, allows patients to make informed choices when seeking care and reimbursement for healthcare, based on how the health information may be used (Herold and Hertzog, 2015). It allows the patients to make choices about how their personally identifiable financial information is used and shared by the organizations, with which they do business, as well as finding out how their information may be used and what disclosures of their information have been made. Herold (2002) argues that privacy enables consumers to find out how their financial information is going to be protected and to know that the people handling their information have been properly trained to protect their privacy. Privacy limits the release of information to the minimum reasonably needed at the time of disclosure. Privacy gives people the right to examine and obtain a copy of their records and request corrections. One serious user privacy issue is the identification of personal information during communication over the Internet, which should be secured by different security tools (Porambage *et al.*, 2016).

On the other hand, security as currently legislated for Saudi consists of the reasonable and prudent policies, processes, steps and tools that are used to maintain confidentiality and privacy (Altuwaijri, 2008). It involves all methods, processes, and technology used to ensure the confidentiality and safety of the once private information that has been entrusted to a third party by the customer or patient (Herold, 2002). According to the HIAPP, security includes the ability to control access to patient information, as well as to safeguard patient information from unauthorized disclosure, alteration, loss, or destruction. Security is typically accomplished through operational and technical controls. According to Ware (1967) and (Jain *et al.*, 2016), information security is the process by which privacy is achieved. The following table presents the differences between security and privacy.

No	Privacy	Security
1.	The appropriate use of users' information.	The confidentiality integrity and availability of the data.
2.	The ability to decide information about the individual is shared.	Offers the ability to be confident that one's decisions are respected.
3.	In the field of defence, protected communications are the responsibility of a government agency, appropriate equipment is available, and the importance of protection over-rides economic considerations.	Circumstantial, secure satisfactory communication equipment is generally not available, and the economics of protecting communications is likely to be more carefully assessed.
4.	It is possible to have a poor privacy system and good security practices.	It is difficult to have good privacy practices without a good data security program.
5.	The data that needs to be secured.	The processes and tools to secure the privacy data.

Table 2-4: The key differences between privacy and security.

The financial risks that could occur due to billing errors in the EHRs software were also an issue. Other risks included, when the computers crashed, software program errors or bugs, issues with automated processes in the system, the systems becoming irrelevant thanks to daily technological advancements, the vendors of the EHRs software becoming obsolete, and also the wrong information being provided to the Decision Support system (DSS) module of EHR systems (Goldschmidt, 2005; Miller *et al.*, 2005).

To measure how extensively hospitals are using Information Technology (IT) and to gain a better insight as to why further adoptions of EHRs are a challenge, the American Health Association (AHA), in 2005, carried out a study in all community hospitals. Participating in this study were different CEOs (19.2 percent) from 900 hospitals. 92 percent of respondents, according to the findings, were in the process of using, testing, or considering IT applications for clinical purposes. Those not considering IT solutions were primarily non-teaching, small, rural, and non-systematic hospitals. Over 50 percent believed that using EHRs functions support reviewing health report in different aspects included the lab results review, lab order entry, radiology order entry, patient's demographics access, and the radiology results EHR (Association, 2005).

Based on the same study, the studies indicated that half of the rural hospitals pointed out that they were starting on IT adoption, with high levels of IT implementation being indicated by urban hospitals. The leading barrier to EHRs adoption was, again, cost. Acceptance of the systems by the clinical officers in 58 percent of the hospitals was also found to be a barrier, while 59 percent also found the initial cost to be a significant barrier. The cost was seen as a major obstacle by 50 percent of smaller hospitals with less than a 300-patient bed size (Association, 2005).

According to research, resistance to change or attitude-behaviour limits is quite a significant limitation (Miller *et al.*, 2005; Valdes *et al.*, 2004). For an information system to be implemented and accepted with minimal or without any resistance from users, there must be correct approaches to its development, presentation, and its ease of use. There is also needed to plan adequately, to manage the transition. Thus, the essential process of Electronic health readiness assessment must be conducted before EHRs are implemented (Ford *et al.*, 2006; Jennett *et al.*, 2003). Previously conducted researches in the area of EHRs help in the identification of existing benefits, risks, and barriers and can similarly analyse the relationship there is between the size of a health facility or a physician's office and their degree and rate of EHRs adoption and implementation (Association, 2005; Moreno, 2005).

Given the results of several studies, a significant barrier to the adoption of EHRs is cost and benefits of using the system (Bates, 2005; Hersh, 2004). The other barriers playing a similar role are issues of confidentiality and privacy, lack of Health Information codes and standards, unavailable skilled clinical informatics workforce, technical errors, system interoperability, and the many different EHR system vendors in the marketplace (Bates, 2005; Brailer and Terasawa, 2003; Hersh, 2004; Sprague, 2004).

If the physicians can be reimbursed for adopting EHRs systems and their investment risk is subsidised, then according to Brailer the adoption of EHRs and HIT will accelerate. In summary, despite the potential and quite significant benefits that HIT promises, barriers to its adoption and implementation by health practitioners, along with the privacy and confidentiality risks. It is necessary to continue with the support of EHRs and HIT and regardless of the risks and barriers, which may face.

This can be done by a high degree of health information standards developed, the needed experienced clinical workforce also acquired, the funds provided, and the attitude of the practitioners changed.

Key Barriers and Risk of using HIT	**References**
Cost related to IT infrastructure.	(Ajami and Arab-Chadegani, 2013a) (Association, 2005)
Privacy and security	(Bates, 2005; Hersh, 2004; Sprague, 2004).
The financial risks.	(Goldschmidt, 2005; Miller *et al.*, 2005).
Computers crash, software program errors or bugs, issues with automated processes in the system.	(Goldschmidt, 2005; Miller *et al.*, 2005).
Change and attitude-behaviour	(Miller *et al.*, 2005; Valdes *et al.*, 2004)
Health Information codes errors and standards, unavailable skilled clinical informatics workforce, technical errors, system interoperability.	(Bates, 2005; Brailer and Terasawa, 2003; Hersh, 2004; Sprague, 2004).
Health Information standards.	(Brailer and Terasawa, 2003)

Table 2-5: Key Barriers and Risk of using HIT

2.9 Review theories behind ICT system Implementation and Adoption

Theories play a significant role in inductive researches. The theory is defined as "a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena" (Webster (1969). This section focuses on exploring the main theories behind ICT system implementation and adoption. There is no doubt in this study that improving an understanding of the factors to adopt HIT able to support answering the research questions. This is necessary to review the technology adoption literature. Furthermore, in this research, various theories have been explicitly or implicitly implemented to understand EHR/EMR adoption, including the theory of reasoned action, the theory of planned behaviour, unified theory of acceptance and use of technology, the technology acceptance model, and the innovation diffusion theory. Following listed off the key various models and authors for examining the predictors of technology adoption are briefly outlined.

Theory	**Author(s), year**
1. Technology Acceptance Model (TAM)	
TAM	Davis, 1989
TRA and TAM (comparison)	Davis *et al.*, 1989
TAM, TPB, and the Decomposed Theory of Planned Behaviour (comparison)	Taylor and Todd, 1995
Extension called TAM2	Venkatesh and Davis, 2000
TAM and TPB (comparison)	Mathieson, 1991
2. Theory of Reasoned Action (TRA)	
TRA and TAM (comparison)	Davis *et al.*, 1989 1995
TRA	Fishbein and Ajzen, 1975
TRA and DOI (combination)	Karahanna *et al.*, 1999
TRA	Ajzen and Fishbein, 1980
3. Diffusion of Innovations (DOI)	
DOI	Rogers, 1983 (different editions)
DOI	Moore and Benbasat, 1991
TRA and DOI (combination)	Karahanna *et al.*, 1999
4. Theory of Planned Behaviour (TPB)	
TAM, TPB, and the Decomposed Theory of Planned Behaviour (comparison)	Taylor and Todd, 1995
TBP	Ajzen, 1991
TAM and TPB (comparison)	Mathieson, 1991
5. Unified Theory of Acceptance and Use of Technology (UTAUT)	
UTAUT combines eight models: TRA, TAM, and TPB	Venkatesh *et al.*, 2003

Table 2-6: Review theories behind ICT system Implementation and Adoption

2.9.1 Technology Acceptance Model (TAM)

One of the most well-known models related to technology acceptance and adoption is the technology acceptance model (TAM), initially developed by Davis Jr (1986). The main purpose of this model is to explain the behaviours of people using information technology and indicates the need for using technology and adoption of innovations. TAM can help explain and predict user behaviour regarding information technology (Legris *et al.*, 2003). According to Ajzen and Fishbein (1980), TAM is based on an essential extension of the theory of reasoned action (TRA). However, studies such as those by Davis (1989) and Davis *et al.* (1989) illustrate why a user accepts or rejects information technology by adopting TRA and TAM. It is clear that TAM includes a basis with which one traces how external variables influence belief, intention to use, and attitude. There are two cognitive beliefs: perceived ease of use and perceived usefulness. TAM is described as the study of user behaviour with technology systems, which is affected directly or indirectly by attitudes, the perceived usefulness of the system, and the perceived ease of the system. TAM also contends that external factors affected intention and actual use through mediated effects on perceived usefulness and perceived ease of use (Davis, 1989).

TAM has been developed four times. The first proposal of this theory was introduced by Davis (1989), which explained the motivation for accepting information technology through three factors: perceived usefulness, perceived ease of use, and behavioural intention to use (BI). Based on this study, BI can be affected by both perceived usefulness and perceived ease of use. The following figure describes the original TAM (Davis, 1989).

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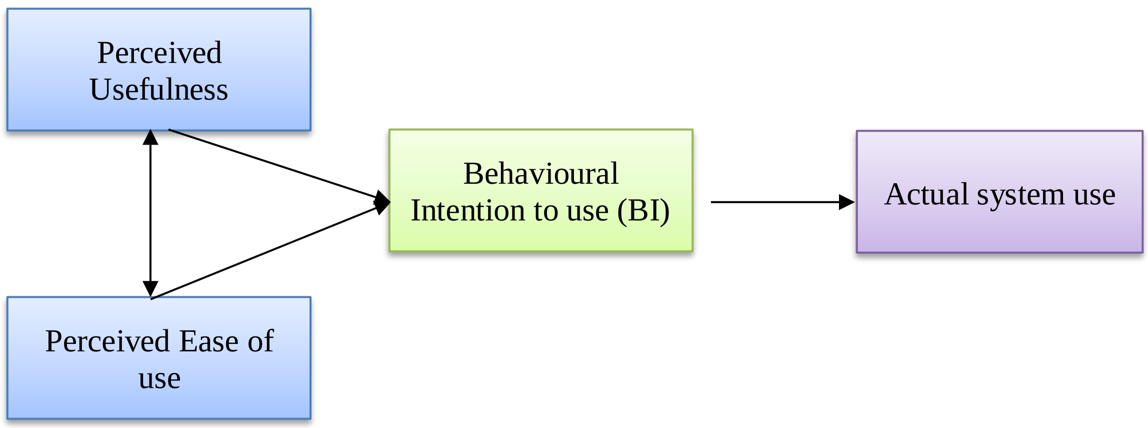

Figure 2-3 Technology acceptance model (TAM) by (Davis 1989, p. 984)

In 1993, Davis developed the model further, suggesting that perceived usefulness had a direct impact on actual system use. He found that critical factors that influence the adoption of a system could be affected by the relationship between perceived usefulness and BI.

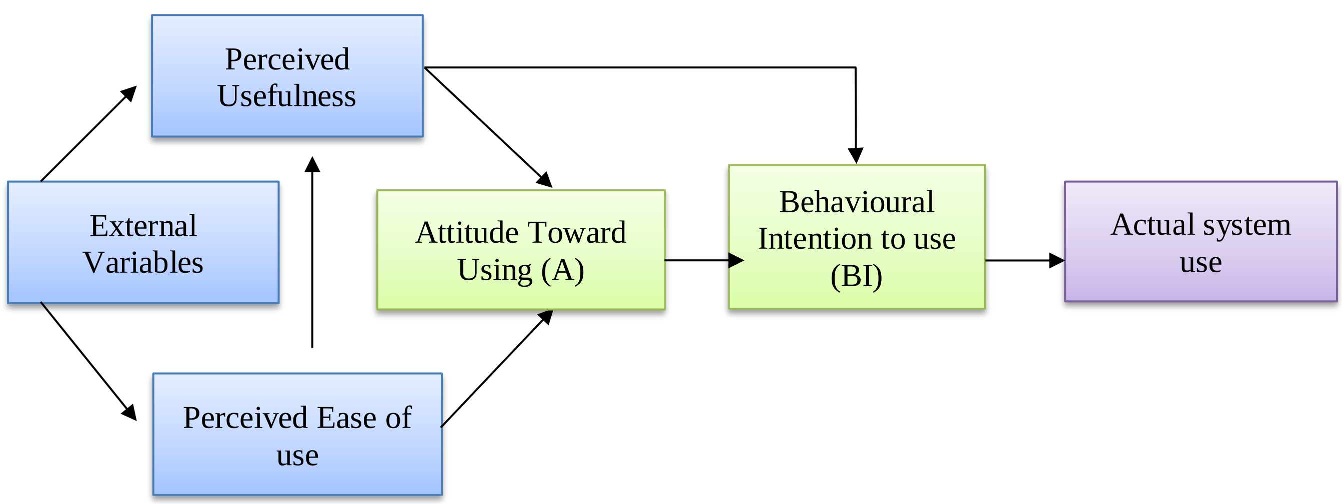

Figure 2-4: Technology acceptance model (TAM) 2nd edition

Venkatesh *et al.* (2003) extended this theory and tested the model with 107 participants. There was a substantial relationship between BI and attitude toward use. The study suggested that BI is affected by two major elements: perceived usefulness and perceived of ease of use. However, the impact of perceived of ease of use on BI is less than perceived usefulness on BI. Additionally, external variables, such as attitude toward use, were excluded from this model. The below diagram presents the latest model.

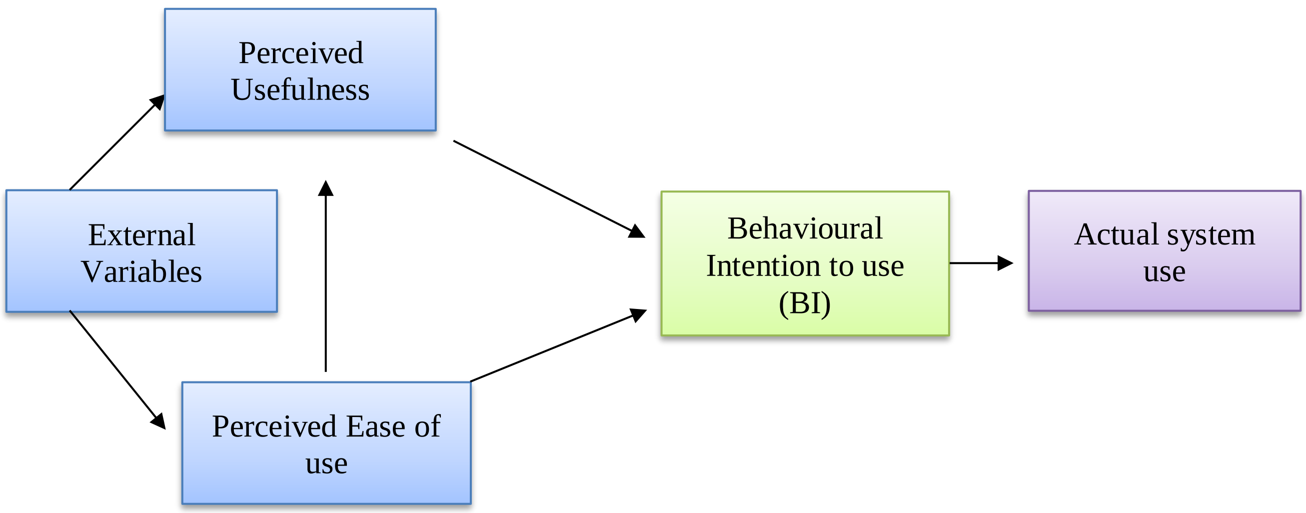

Figure 2-5: Technology acceptance model (TAM) 3rd edition

Furthermore, in healthcare, (TAM) suggests that perceived usefulness and perceived ease of use influence users’ attitudes towards using a new technology for both patients and clinic staff. Users can show positive feelings about new technology if the user believes it is useful for job performance. Thus, users' attitudes towards using a new technology will be more positive (Pai and Huang, 2011). Such attitudes will affect the user's behavioural intention and actual system use. Additionally, external variables can also impact users' internal attitudes, intentions, and beliefs. Early studies showed that different external variables influence perceived usefulness and perceived ease of use.

According to Hong *et al.* (2002), five internal variables influence individual perception: the computer's self-efficacy, the relevance of the technology, the terminology and the screen design, and the user's knowledge of the search domain. On the other hand, Lewis *et al.* (2003) explored external variables, including institutional factors, social factors, and individual factors.

2.9.2 Theory of Reasoned Actions (TRA)

The theory of reasoned actions (TRA) has been used in several studies and fields. According to Ajzen and Fishbein (1980), TRA was developed to examine the relationship between attitudes and behaviour. TRA focuses on behavioural intentions, rather than attitudes, as the main predictors of behaviour (Ajzen and Fishbein, 1980). Based on this theory, attitudes toward behaviour (more practically, attitudes toward the expected outcome of behaviour as well as subjective norms that other people have on a person's attitudes) and behaviour are the major predictors of behavioural intention (Ajzen and Fishbein, 1980).

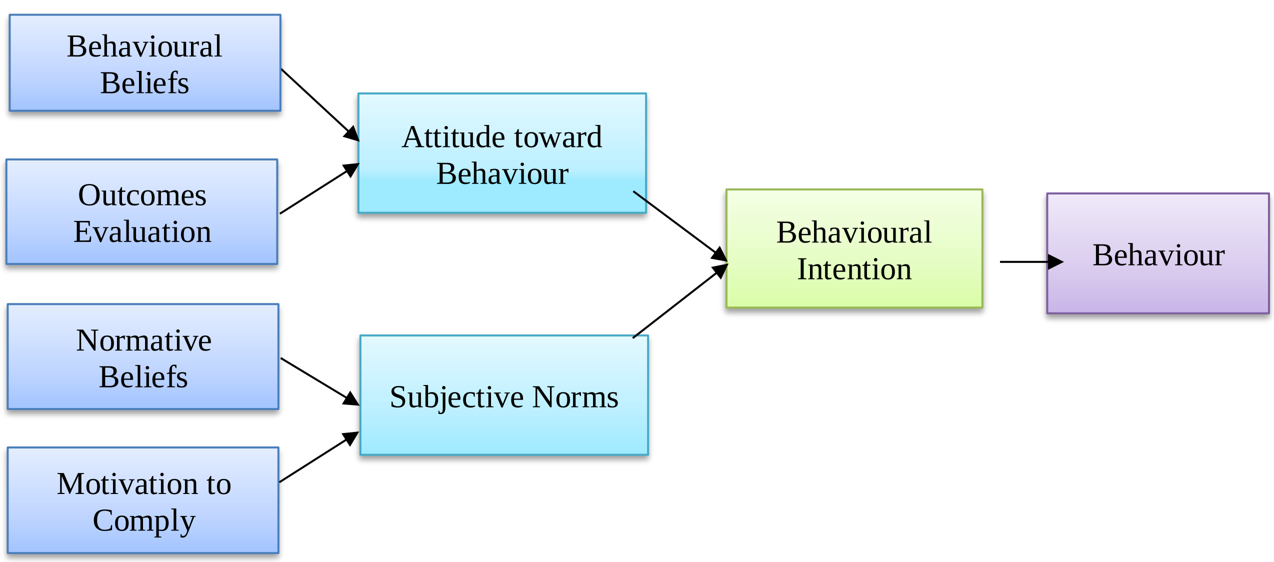

Figure 2-6: Theory of reasoned action (TRA) by (Ajzen & Fishbein, 1980 p. 47).

According to Ajzen and Fishbein, the intention in TRA is the "probability, as stated by the respondent, that he/she will perform the stated action" (Ajzen & Fishbein, 1980, p.180). Intention consisted of attitudes toward behaviour (AB) as well as subjective norms (SN). Ajzen and Fishbein (1980) mentioned other variables, which should be added to TRA but can only affect intention and, therefore, behaviour. There is no doubt that these elements refer to an intention to perform the behaviour in question (Ajzen and Fishbein, 1980). Furthermore, behavioural intentions can be described as the motivational factors that influence behaviour; they are indications of how hard people are willing to try and of how much effort they are planning to exert in performing the behaviour (Ajzen, 1991). Also, the research of both Ajzen and Fishbein (1980) has shown "a person's subjective probability that he will perform some behaviour" (Fishbein and Ajzen, 1980, p.288).

According to Olsen *et al.* (1993), intentions do not correctly predict behaviour. For instance, he listed some elements that could affect the strength of the relationship between getting intention and getting behaviours. Additionally, these factors can be included as "intervening time, different levels of specificity, unforeseen environmental events, unforeseen situational contexts, the degree of voluntary control, the stability of intentions, and new information. Obviously, intention can change over time" (Olsen *et al.*, 1993, p.319).

The attitude stands for the general feeling of favourableness or unfavourableness toward a concept. Related to TRA, the primary determinant of a specific intent to act, as mentioned earlier, is perspective. Ajzen and Fishbein (1980) mentioned that perspective towards behaviour is the estimation of a positive or negative self-evaluation about a correct behaviour.

This construct depends on whether the behaviour is positively or negatively reputable. It is "determined by a total set of accessible behavioural beliefs linking behaviour to various outcomes and other attributes" (Ajzen and Fishbein, l980, p.283). Thus, perspective is an individual's salient belief that the result of his or her behaviour is positive or negative. Therefore, once a user has salient positive beliefs concerning his behaviour, he then encompasses a positive perspective about that behaviour. The other applies once he has salient negative beliefs concerning a positive outcome of his purchase behaviour that is then thought to be a negative perspective.

Ajzen and Fishbein's studies mentioned that subjective norms are a person's estimate of the social pressure to perform or not perform the intended behaviour. These studies relate to an individual's perception of what other people think about their behaviour. Therefore, these behaviours can affect their performance (normative belief), as well as the degree to which this influences the behaviour or action of the person responsible (motivation to comply). In other words, both motivation to comply and normative belief build the subjective norm, irrespective of the individual's opinion. Users' opinions are essential to others around using technology; it can change the behavioural outcome in accepting technology positive or negative. (Ajzen and Fishbein, 1980).

2.9.3 Theory of Planned Behaviour (TPB)

The theory of TPB, proposed by Ajzen (1991), links beliefs about behaviour with technology use. Ajzen improved the theory of reasoned action by including perceived behavioural control. This theory explains human behaviour and has been applied to studies of beliefs, attitudes, behavioural intuitions, and behaviours in different fields, including healthcare. According to Ajzen, there are four key elements of this theory: behavioural beliefs and attitude toward behaviour, normative beliefs and subjective norms, control beliefs and perceived behavioural control, and behavioural intention and behaviour.

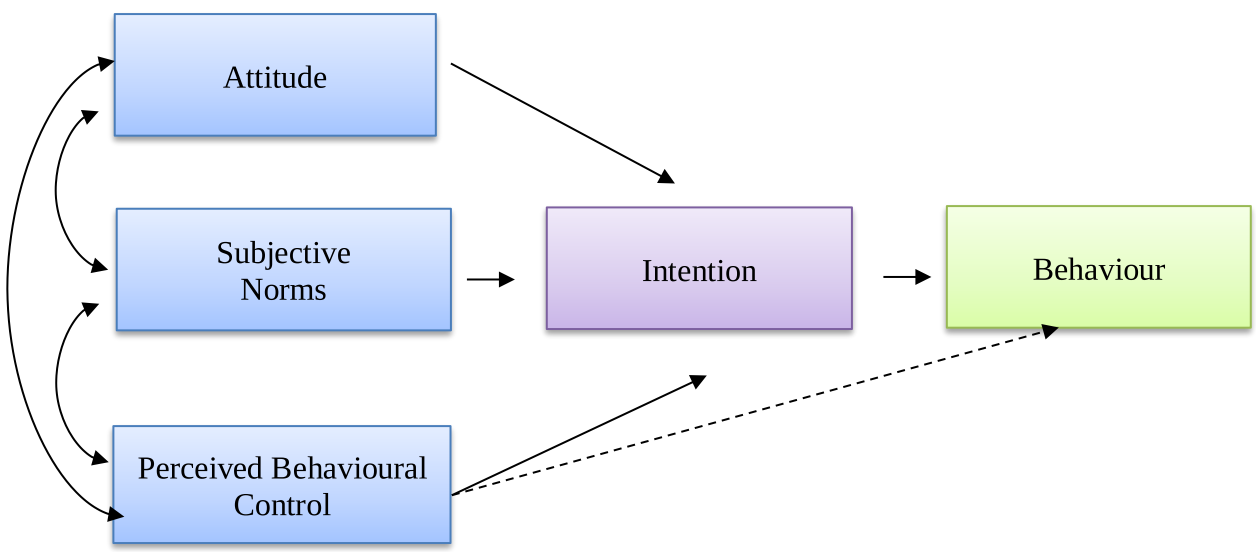

Figure 2-7: Theory of planned behaviour by Ajzen (1991, p. 182).

As can be seen above, the theory of planned behaviour considers the central determinant of behaviour to be one's intention to perform the particular behaviour (Ajzen, 1991). It seeks to predict original intentions, based on a combination of three influencing factors: individuals' attitudes, subjective norms, and perceived behavioural control.

There is no doubt that an individual's attitude towards a given behaviour is based on their belief that the behaviour will lead to the desired outcome and their evaluation of the outcome. These beliefs are referred to as behavioural beliefs. In addition, the subjective norm is related to an individual's perception of the social norm or pressures to perform the behaviour and their desire to comply with this standard. The perceptions about other significant preferences, regarding whether or not they should perform the behaviour, are referred to as normative.

The last element is perceived behavioural control (PBC), which refers to the individual perception of ease or difficulty of performing the behaviour. It is clear that this consists of one's perceived access to necessary resources and opportunities to perform the behaviour successfully, weighted by a power of each factor (Ajzen, 1991). Take beliefs, for example, about which factors perceived to facilitate and inhibit the behaviour are referred to as control beliefs and may be based in part on experience (Ajzen, 1991). These are either internal factors, which include individual differences, information, skills, abilities, and willpower, or external factors, for example, time, opportunity, and dependence on others (Ajzen, 1991). Perceived behavioural control is viewed as a measure of actual control. Perceived behavioural control is understood to have both direct effects on behaviour, alongside or independent of intention, or indirect effects through intention (Ajzen, 1991).

The behavioural beliefs, normative beliefs, and control beliefs comprise the most salient beliefs. They are specific indirect measures, understood to be the antecedents to the global direct action of these three variables. The model suggests that a person with a strong intention performing the behaviour is more likely to have a strong belief that the behaviour can bring about desired consequences (attitude), will have people important to them who approve of the behaviour and a strong desire to desire to comply with their opinion (subjective norm), and will have perceived resources (perceived control) to perform the behaviour. The relative importance of these three determinants is expected to vary across situations and behaviours; sometimes one component may be the most significant predictor of intentions or a combination of the components, or all three may contribute independently to the prediction of intentions (Ajzen, 1991).

2.9.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT was introduced by Venkatesh *et al.* (2003), who presented four main factors, including performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). The behavioural intention aspect of the effect influences these elements, where there are other aspects that merge with the previous elements and increase the effect, such as gender, age, experiences, and volunteer. Behavioural intention is seen as a critical predictor of technology use.

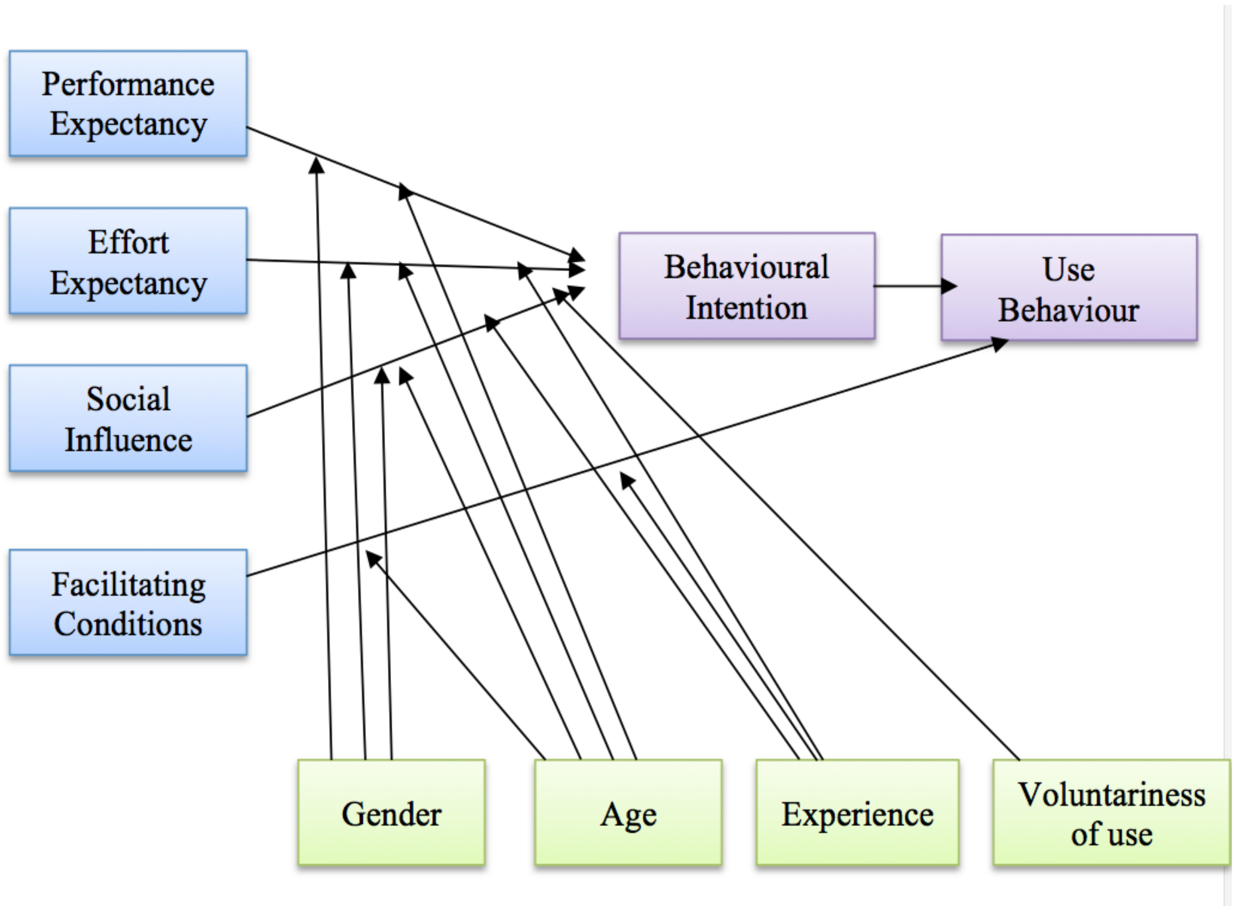

Figure 2-8: Unified theory of acceptance and use of technology (UTAUT) by Venkatesh *et al.* (2003, p. 447).

According to Venkatesh *et al.* (2003), four elements influence the UTAUT. First of all, performance expectancy, which is the degree to which individual behaviour using the system, will help an individual improve job performance. Both gender and age are hypothesised to moderate the influence on behavioural intention. Secondly, effort expectancy is defined, as the degree to which the individual perceives that it is essential that others believe the users should use the new technology. Effort expectancy is hypothesised to moderate the influence on behavioural intention by experience, age, and gender. The third element is a social influence, described by Venkatesh as the degree to which an individual perceives how essential it is that others use the new system. Social influence is hypothesised to moderate the influence on behavioural intention due to gender, age, experience, and volunteers of the system. Lastly, according to Venkatesh *et al.* (2003), facilitating conditions is the extent to which an individual believes that an organisational and technical infrastructure can support the use of the system, hypothesised to moderate the influence on behavioural intention by age and experience.

2.9.5 Diffusion of Innovation Theory

The section aims to present a detailed literature review on Roger’s (2010) Theory of Diffusion of Innovation. This is a process of new adoption amongst people in an organisation or group to achieve goals and maintain a significant position in society or within an organisation. The path for adopting novel innovations has remained a focus of research for many years. However, Rogers, in his book ‘Diffusion of Innovations,' introduced a framework known as Roger’s Adoption Model (Rogers, 2010). Much research has been carried out on this topic to understand the importance of diffusion of innovation in contemporary organisations, specifically on the belief that innovation is one of the most significant methods of social and technical change in an organisation. In light of different research approaches, the following section will analyse and discuss various topics and theories related to the theory of diffusion of innovation, in order to provide an overview of this theory and why it is such an important subject of discussion (Kaminski, 2011). It will also provide an in-depth discussion of the innovation adoption decisions, beliefs and attitudes, organisational characteristics, social systems, and other aspects of this study.

Rogers explained the diffusion of innovation theory as an adoption model that comprises innovation, communication networks, phases/time periods, and social structures as the four fundamental mechanisms in the diffusion of innovations. Rogers' theory is highly applicable when examining the adoption of technology in many different settings, industries, and organisations. Moreover, most diffusion research includes technological innovations, so Rogers frequently used the term 'technology' and 'innovation' interchangeably. Theories of innovation in the industry have stemmed primarily from the efforts of an economist, Joseph A. Schumpeter. He observed innovation as different from invention, which he suggested, arose from the segregation of innovations, and which might be better combined with innovation. Schumpeter further discussed innovation as the creation of new equipment, the development of new businesses, and the growth of leadership among new generations. From this viewpoint, innovation is considered an irregular occurrence (Fitzgerald *et al.*, 2002).

It is only in recent years that social scientists have given more consideration to the concept of innovation, with a noticeable focus on creativity and, specifically, how the creative process takes place. A study by Mustonen-Ollila and Lyytinen (2003) and Barnett (1953) indicated that innovation is the foundation of social and cultural change, whereupon they describe innovation as "any thought, behaviour, or thing that is new because it is qualitatively different from existing form" (Barnett, 1953, p. 7).

In contrast, the practice of diffusion is defined by Greenhalgh *et al.* (2005) as the acceptance over time of a specific idea, piece of knowledge, or belief, by persons, groups, or other entities, associated with precise networks of communication, in a social system, and in a provided system of standards, or practices. The differences in academic debate across sociology, anthropology, mass communications, and other fields are revised and clarified by Greenhalgh (2005).

Rogers (2010) described diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2010, p.5). Diffusion research examines how ideas are circulated between sets of individuals. Diffusion moves beyond the two-step flow principle, focusing on the circumstances that increase or reduce the probability that followers of a specific culture will adopt an innovation, novel idea, creation, or practice. In multi-step diffusion, an opinion leader has the most significant impact on the behaviour of people (termed adopters). Nonetheless, there are likewise new influencers, including the media, and an individual’s decision-making. One influencer is the change agent, somebody who reassures opinion leaders in their adoption, or discarding, of innovations.

Furthermore, Dearing (2009) proposed that few social science theories have a history of theoretical and pragmatic study involving the diffusion of innovations. The strength of this theory behind Diffusion of Innovation originated from various criticisms and different fields of study in which diffusion has been researched. Initial speculation at the beginning of the twentieth century was progressively replaced by post hoc experimental research that defined and clarified diffusion processes. By the late 1950's, diffusion researchers had collated the shared knowledge of real diffusions in the assessment of innovation diffusion processes. In recent times, this has provided a proposed system of the science of diffusion, in which evidence-based practices are undertaken.

2.9.5.1 ***Innovation***

Rogers presented the following explanation of innovation: "innovation is an idea, practice, or project that is perceived as new by an individual or another unit of adoption" (Rogers, 2010, p.12). Innovation may have been designed at any point in time, but it can be seen as an innovation for individuals at a different point, the point at which they recognise it as being novel to them. The distinctiveness of an adoption is further associated with three steps (knowledge, persuasion, and decision) of the innovation-decision process. In addition, Rogers demonstrated the existing insufficiency of diffusion research on technology collections as groups. For Rogers, "a technology cluster consists of one or more distinguishable elements of technology that are perceived as being closely interrelated" (Rogers, 2010, p.15).

2.9.5.1.1 Communication Channels

The next component of the diffusion of innovations theory relates to communication channels. These are defined as methods or procedures where individuals design and share information amongst one another, with the aim of creating mutual understanding. This has helped several organisations to develop understandings between employees, and to obtain efficiency in workflows throughout the organisation. Rogers further suggests that diffusion is an explicit form of communication, which comprises communication elements such as innovation, more than one individual or unit of adoption, and a communication channel.

2.9.5.1.2 Time

According to Rogers (2010), the importance of time is often overlooked in most behavioural analyses. He contends that incorporating a measurement for a time in diffusion surveys shows potential. The innovation diffusion paths, adopter classifications, and rate of selections, all incorporate an element of time.

2.9.5.1.3 Social System

The specific social system is the final and most important component in the diffusion process. It is described as "a set of interrelated units engaged in joint problem solving to accomplish a common goal" (Rogers, 2010, p.23). When diffusion of innovations occurs in social systems, it is influenced by the social configuration of that system. Furthermore, the nature of the social system highly influences an individual's innovativeness, which remains a core principle for classifying adopters. A social system is described as a set of interconnected components that are involved in combined problem solving to achieve a mutual goal. The participants or entities of a social system can be individuals, casual groups, societies, or organisations. The social system establishes a boundary within which an innovation circulates. How the system's social configuration impacts upon diffusion have been studied.

The research by Rogers, (2010) is further complicated by how standards or norms affect diffusion. Standards are the recognised behaviour designs for participants in a social system. Another area relates to opinion leaders, i.e., the amount to which a person can easily affect other peoples' attitudes or behaviours in a prescribed manner. A change agent is an individual who attempts to influence a user’s innovation-decisions in a way that is believed necessary by the change agent.

Over the years, social scientists have presented some descriptions of legitimacy. However, legitimisation or legitimation can be identified as social sciences related to the process that can act or ideology which becomes legitimate by attachment to norms and values within a given society (Suchman, 1995). It is an attempt to reduce user uncertainty about new products processes and services in order to promote the development of the new market. For instance, keeping a phone silent in the meeting can be called legitimation.

There is no doubt that the current research on innovation and commercialisation of emerging technologies is focused on both public and private sectors, each playing a role in legitimising new technologies. According to Suchman (1995), organisations seek legitimacy for many reasons; the effectiveness of legitimation efforts may depend on the targets against which these efforts are measured. In addition, some authors have found that organisational legitimacy includes two camps, which are strategic and institutional (Suchman, 1995). The strategic approach is the most challenging part to influence the institutional framework to get an institutional alignment (Bergek et al., 2008; Oliver, 1991; Zucker, 1987).

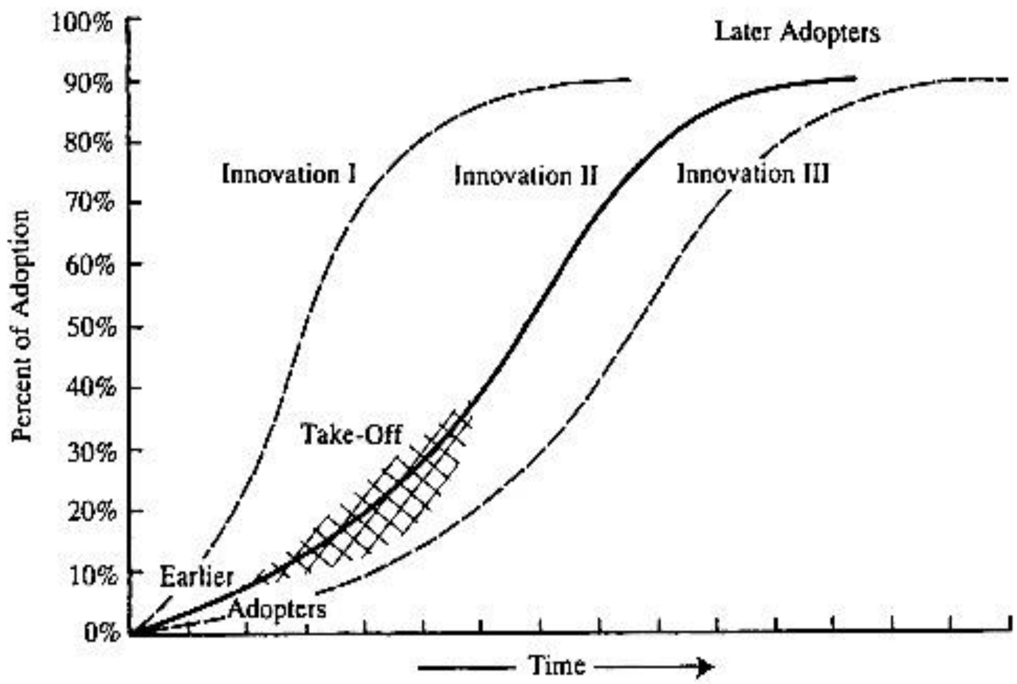

Figure 2-9: Present of adoption and source by Rogers, 2010. (Fichman and Kemerer, 1999, p.11)

However, Fichman and Kemerer (1999) argued that the novelty of an innovation several be uttered in rapports of knowledge, persuasion, or decision to adopt. In most research on diffusion, the area of early and late adopters in innovation is unclear. In addition, research into the observed characteristics of innovation, such as its relative advantages or its compatibility, affects its rate of adoption.

2.9.5.2 The innovation adoption decision

Rogers (2010) termed the innovation-decision process as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of innovation." (Rogers, 2010, p. 165). The innovation-decision process encompasses five steps:

1. Knowledge Stage
2. Persuasive Stage
3. Decision Stage
4. Implementation Stage
5. The Confirmation Stage

These steps typically follow each other chronologically. Individuals do not adopt innovations in a social system at the same time. Instead, they tend to adopt at different times and can be classified into adopter categories based on how long it takes for them to begin using the new idea. Practically speaking, it is beneficial for a change agent to be able to identify which category certain individuals belong to since the short-term goal of most change agents is to facilitate the adoption of innovation. Human interaction most often causes the adoption of a new idea through interpersonal networks. If the initial adopter of an innovation discusses it with two members of a given social system, and these two become adopters who pass the innovation along to two peers, and so on, the resulting distribution follows a binomial expansion. As such, this would expect adopter distributions to follow a bell-shaped curve over time (Sahin, 2006).

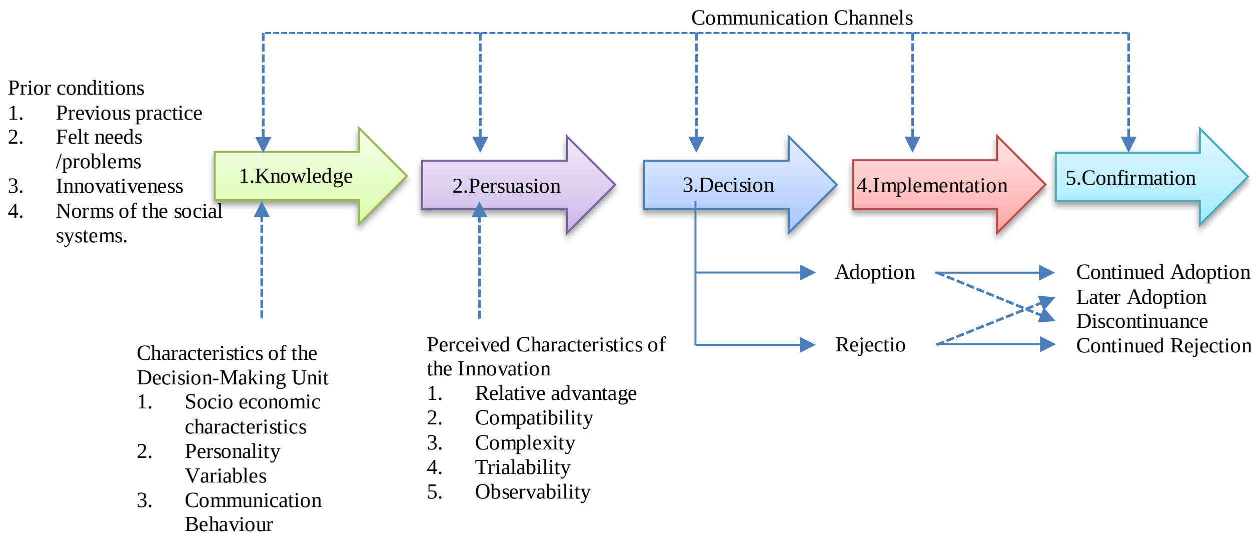

Figure 2-10: The innovation-decision process initiates source by Rogers, 2010 (Sahin, 2006, p.170).

2.9.5.2.1 The Knowledge Stage

The innovation-decision process begins with the knowledge stage. In this stage, a person researches the presence of the innovation and seeks evidence relating to it. Throughout this stage, a researcher tries to determine "what the innovation is and how and why it works" (Rogers, 2010, p.21). This researcher goes beyond just understanding knowledge and instead tries to determine every phase of innovation and answer several questions about the innovation (Sahin and Thompson, 2006).

- Awareness knowledge: Awareness-knowledge represents knowledge of the innovation's existence. This type of knowledge can motivate individuals to learn more about the innovation and, eventually, to adopt it. It may also encourage an individual to acquire two other types of knowledge (Sahin, 2006).
- How-to knowledge: How-to knowledge contains information about how to use an innovation correctly. Even those with experience in teaching technology may not know how to use particular innovations correctly. Thus, technology is not used as expected. Rogers saw this knowledge as an essential variable in the innovation-decision process (Greenhalgh *et al.*, 2005).

- To increase the chances of innovation being adopted, an individual should have a sufficient level of how-to-knowledge before the trialling of this innovation. Thus, this knowledge becomes more critical for relatively complex innovations (Sahin, 2006).
- Principles knowledge: This knowledge involves the functioning principles describing how and why an innovation works. Innovation can be adopted without this knowledge, but the misuse of the innovation may cause its discontinuance. The most significant barrier to the use of technology in working is that users lack the vision of why or how to integrate technology into the workplace.

To create new knowledge, technology and practice should provide, not only how-to experience but also a known-why needs experience. In fact, an individual may have all necessary knowledge, but this does not mean that the individual will adopt the innovation, as an individual's attitudes also shape the adoption or rejection of innovation (Sahin, 2006).

2.9.5.2.2 The Persuasion Stage

The persuasion stage happens when an individual has a negative or positive attitude toward innovation, but according to Sahin and Thompson, 2006 the realisation of a favourable or unfavourable attitude to innovation does not continuously lead straight or circuitously to an adoption or rejection (Sahin and Thompson, 2006). As such, an individual forms his or her attitude once he or she identifies the innovation. As such, the persuasion stage mirrors the knowledge stage in the innovation-decision process. Furthermore, Rogers states that while the knowledge stage is more cognitive (or knowing) centred, the persuasion stage is more effective (or feeling) centred. Thus, an individual is involved more sensitively with the innovation at the persuasion stage.

The degree of uncertainty about the innovation's functioning, and the level of social reinforcement from others (colleagues, peers, etc.), affects an individual's opinions and beliefs about the innovation. Close peers' subjective evaluations of the innovation that reduce uncertainty about the innovation outcomes are usually more credible to an individual: "while information about an innovation is generally available from outside experts and scientific evaluations, teachers usually seek it from trusted friends and colleagues whose subjective opinions of an innovation are most convincing" (Sherry, 1997, p.70). Individuals continue to search for innovation-evaluation information and messages throughout the decision stage (Graham and Logan, 2004).

2.9.5.2.3 The Decision Stage

At the decision stage in the innovation-decision process, an individual chooses to adopt or reject an innovation. While adoption refers to the "full use of innovation as the best course of action available," rejection means, "not to adopt an innovation" (Rogers, 2003, p.177). If an innovation has a partial trial basis, it is usually adopted more quickly, since most individuals first want to try the innovation in their environment and then come to an adoption decision. Such a trial can speed up the innovation-decision process (Sahin, 2006). However, rejection is possible at every stage of the innovation-decision process. Rogers expressed two types of rejection: active rejection, and passive rejection. In an active rejection situation, an individual tries an innovation and thinks about adopting it, but later he or she decides not to adopt. A discontinuance decision, which is to reject an innovation after adopting it earlier, may be considered as an active type of rejection. However, in a passive refusal (or non-adoption) position, the individual does not think about adopting the innovation at all. Rogers stated that these two types of rejections have not been distinguished and studied enough in past diffusion research.

In some cases, the order of the knowledge-persuasion-decision stages can be changed to knowledge-decision-persuasion (Sahin and Thompson, 2006). Especially applicable in collectivistic cultures such as those in Eastern countries, this second order often occurs, with group influence on adoption of an innovation transforming the personal innovation decision into a collective innovation-decision. In any case, however, the implementation stage follows the decision stage (Fitzgerald *et al.*, 2002).

2.9.5.2.4 The Implementation Stage

At the implementation stage, innovation is put into practice. However, an innovation brings with it the newness in which "some degree of uncertainty is involved in diffusion" (Chan and Williamson, 1999, p87). Uncertainty about the outcomes of the innovation can still be a problem at this stage. Thus, the implementer may need technical assistance from change agents and others to reduce the degree of uncertainty about the consequences of implementation (Henderson *et al.*, 2012). Moreover, the innovation-decision process will end, since "the innovation loses its distinctive quality as the separate identity of the new idea disappears" (Rogers, 2010, p.173). Reinvention usually happens at the implementation stage, and so it is an essential element of this stage. Reinvention is "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers, 2010, p.174). Rogers (2010) also explained the difference between invention and innovation. While "invention is the process by which a new idea is discovered or created," the adoption of innovation is the "process of using an existing idea" (Rogers, 2010, p.174). Rogers further suggested that the more reinvention that takes place, the more rapidly an innovation is adopted and becomes institutionalised. As innovations, computers are tools that provide many possible opportunities and applications, and as such, computer technologies are more open to reinvention.

2.9.5.2.5 The Confirmation Stage

Human behavior change is motivated in part by a state of internal disequilibrium or dissonance, an uncomfortable state of mind that the individual seeks to reduce or eliminate (Rogers, 1983). According to Rogers even after an adoption decision is made about an innovation it is human behaviour to seek information about the innovation to feel motivated or to shred of the innovation. Rogers (2003) argues that even after the decision of adoption is made it can be reversed if the individual is "exposed to conflicting messages about the innovation. However, the individual tends to stay away from these messages and seeks supportive messages that confirm his or her decision (Sahin, 2006). It is in this stage that attitude of a person towards the innovation formed in persuasion stage play a huge role whether the person will continually adopt of discontinue the adoption. the discontinuance that may occur in this stage can be of two types replacement discontinuance and disenchantment discontinuance.

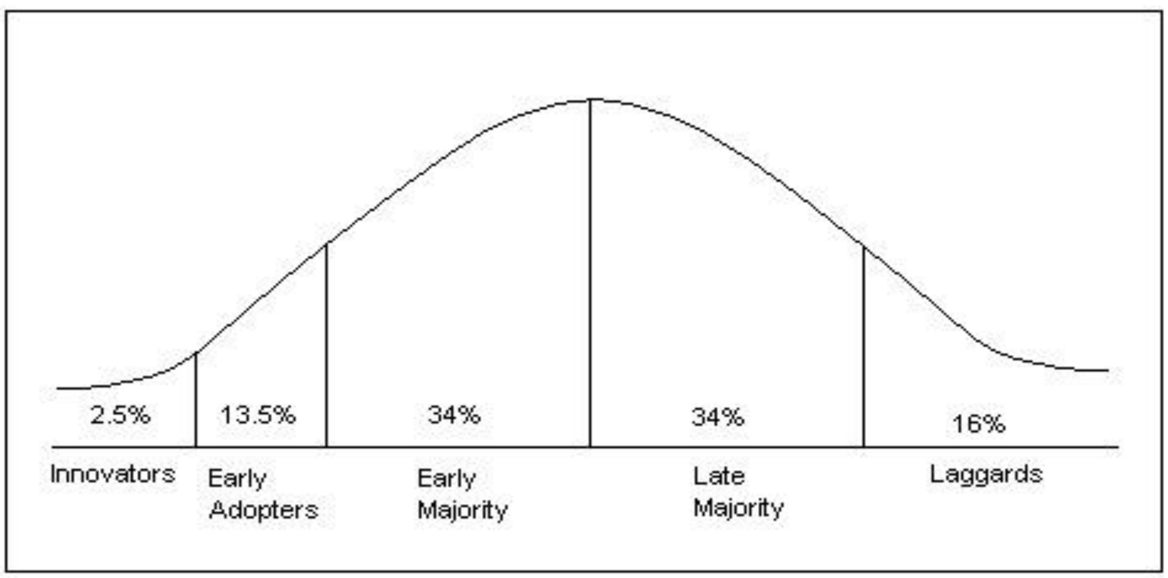

Figure 2-11: Adopter Categorization by (Rogers, 2010, p. 247)

2.9.5.3 Characteristics of the Innovation Organization

Organisations face more complex adoption possibilities because such organisations are both the aggregate of its individuals, and its system with a set of procedures and norms (Dobbins *et al.*, 2001). Three organisational characteristics strongly correlate with the individual characteristics discussed above: tension for change (motivation and ability), innovation-system fit (compatibility), and assessment of implications (observability). Organisations can feel pressure through a tension for change. If the organisation's situation is untenable, it will be motivated to adopt an innovation to change its fortunes. This tension often plays out among its members. Innovations that match the organisation's pre-existing system, which require fewer coincidental changes, and which are easy to assess, are more likely to be adopted (Dobbins *et al.*, 2001). The broader environment of the organisation, often an industry, community, or economy, also exerts pressures on the organisation. Where innovation is diffusing through an organisation's environment for whatever reason, the organisation is more likely to adopt it. Innovations that are intentionally spread, including by political mandate or directive, are also likely to diffuse quickly (Sahin, 2006).

Innovations are often adopted by organisations through two types of innovation-decisions: collective innovation decisions, and authority innovation decisions. The collective decision occurs when adoption is by consensus. The authority decision occurs by adoption among a minimal number of individuals with high positions of power within an organisation. Unlike the free innovation-decision process, these decision processes only occur within an organisation or hierarchical group. Within an organisation, certain individuals are termed "champions"; those who stand behind an innovation and break through opposition (Miron *et al.*, 2004). The champion plays a very similar role to the champion used within the efficiency business model, Six Sigma. The Six Sigma process contains five stages that are somewhat similar to the innovation-decision process that individuals undertake.

These stages are agenda-setting, matching, redefining/restructuring, clarifying, and routinizing (Kontoghiorghes *et al.*, 2005).

2.9.5.3.1 Relative Advantage

Relative advantage is the degree to which an innovation is alleged improved compared to the idea it surpasses. The amount of relative advantage possible will be restrained in different economic environments; however, social-prestige factors, suitability, and gratification are also considered essential mechanisms. It does not matter significantly whether an innovation has an "objective" benefit. What does matter is if a person observes the innovation as beneficial? The higher the perceived relative advantage of innovation, the more quickly its rate of adoption will be. The degree of relative advantage is often referred to as economic productivity, social status, or as other indicators. The nature of the innovation regulates exactly what precise type of relative advantage (such as economic, social, and so on) is significant to adopters, even though the features of the probable adopters also dictate which components of relative advantage are most important.

2.9.5.3.2 Compatibility

Compatibility refers to the point at which an innovation is considered dependable within general principles, past proficiencies, and needs of prospective adopters. Any indication that the innovation is not compatible with established values and standards within a given social system would result in the innovation not being accepted as promptly as one that demonstrates compatibility. The acceptance of a less-compatible innovation frequently necessitates the previous adoption of a novel significance organisation system. Such compatibility assists an individual in feeling more familiar with the new idea. Innovation can be compatible or incompatible with socio-cultural values and beliefs, previously introduced ideas or client-needs for the innovation.

2.9.5.3.3 Complexity

Complexity is the level to which an innovation is difficult to comprehend and apply. Large members of a social system willingly understand specific innovations; other innovations are more complicated and will be accepted more gradually. New ideas that are easier to comprehend are adopted more quickly than innovations that necessitate the adapter to possess new skills. Any new idea may be classified on a complexity-simplicity continuum, where some innovations are understood by potential adopters and others are not (Rogers, 2003).

2.9.5.3.4 Trialability

Trialability refers to the degree to which innovation can be tested on a partial basis. Original ideas that can be partially tested will, in general, be accepted more rapidly than innovations that are not available for partial use. An innovation that is trialable presents fewer uncertainties to people who are considering adopting it. Personally, trialling an innovation provides a way for individuals to give meaning to innovation, and to find out how it works in their environment. Such trials can help dispel uncertainty about a new idea (Rogers, 2010).

*2.9.5.4 **Uncertainty and perceived risk***

Rogers (2010) defined uncertainty as the degree to which some alternatives are perceived concerning the occurrence of an event and the relative probability of these alternatives. There is an inverse relationship between uncertainty and information so that the more information a person has about something, the less uncertainty there is. The relevance work of Rogers (2010) is supported that, technological innovation embodied information and thus reduces uncertainty about cause-effect relationships in problem-solving. Moreover, Rogers (2010) points out that some degree of uncertainty and perceived risk is involved in the innovation-decision process. Obtaining information, which affects uncertainty in a situation where a choice exists among a set of alternatives, can reduce this.

2.9.5.5 Values, Beliefs, and Attitudes

Values, beliefs, and attitudes are concerned characteristics in the diffusion of innovations and the theory of reasoned action (TRA). Rokeach (1969) defines value as a type of belief that is based on principles and standards that have to be reached. Value is defined as essential and lasting beliefs or ideals, usually shared by members of culture, about what is good or bad and desirable or undesirable. Values have a significant influence on a person's behaviour and attitude and serve as broad guidelines in all situations. It is an individual's values that will determine their behaviour in most situations (Stevenson, 2010). In addition, a value is used with beliefs that effect on behaviour or idea. There are also typical values, which are widely shared amongst groups, cultures, or communities. They are passed on through sources such as institutions, religious, media organisations, or family.

Furthermore, beliefs come from experiences about something by individuals or groups. According to (Rogers, 2003), beliefs can be compatible and sociocultural and are linked to the word 'value'. Furthermore, beliefs can help to guide groups or individuals.

The word 'attitude' can relate to a permanent group of beliefs, feelings, and behaviour propensities directed towards people, groups, ideas, or objectives. An attitude is a belief about something and that our thinking is the 'proper' way of doing something. According to Smith *et al.* (2008), attitudes can be positive and negative; it will tend to behave in a certain way toward that person or object.

2.9.5.6 Resistance to adoption

There is valuable literature that uses a critical feminist to study resistance to new technology (Laumer, 2011). However, adopting can involve resistance in an individual with a low level of education. According to Yılmaz and Kılıçoğlu (2013) explain the different views looked at resistance to adopt or change. Yılmaz and Kılıçoğlu (2013) stated that the organisation should be able to accept change by practising for the new state. Furthermore, the organisations have to adopt need to review the environment comfortably process and that including structure, procedures, and policies. However, there are several reasons to reject change take, for example, the believing that change is not worth time, attention, and effort.

Consequently, to understand the logic behind resistance to change performed in organisations, it is necessary to consider the type of resistance (Burke, 2017; Hambrick and Cannella, 1989). Specifically, resistance may be blind, political, or ideological. Moreover, there is a list of causes of resistance to change: interference with need fulfilment, selective perception, habit, economic implications, inconvenience or loss of freedom, security in the past, fear of the unknown, threats to power or influence, knowledge and skill obsolescence, organizational structure, and limited resources (Hambrick and Cannella, 1989). Additionally, to overcome resistance to change, Yılmaz and Kılıçoğlu (2013) presented methods administrators can use, such as education and communication, negotiation and agreement, facilitation and support, participation and involvement, explicit and implicit coercion, and manipulation and co-optation.

2.9.5.7 *Information sources*

An information source is described as a thing, place or a person from which information is derived, obtained or arises (Hornby and Wehmeier, 1995). Information sources include mass media sources, peer sources, authoritative sources, and commercial sources (Mason, 1964). There are also various outsource for information, which is divided into primary, secondary, and tertiary (Stewart and Kamins, 1993).

In summary, innovation is the creation of new knowledge, ideas, or processes, which aim to bring about beneficial changes in an organisation or society. Furthermore, innovation is crucial for society and industrial competitiveness among businesses in a variety of sectors. In light of this, the literature review outlined numerous key authors and critically evaluated their theories in the field of innovation. The primary purpose of this review was to discuss the diffusion of innovation theory proposed by Rogers, which was discussed in depth throughout the chapter. Rogers strongly believed that the diffusion of innovation is significant for all organisations, but also added that adopting an innovation is not a straightforward process. This literature review has also examined a variety of studies in order to provide an overview of the theory of diffusion of innovation.

Table 2-7: The summary of the ICT system implementation and adoption

REFERANCES	THEORY DESCRIPTION	THEORY CHARACTERSTICS	THEORY PROCESS
THEORY OF REASON ACTION BY AJZEN & FISHBEIEN 1980)	The theory is based on social psychology theory which able to describe an individual's behaviour in acquiring such as innovation	TRA is included the relations between the attitudes, intentions, behaviours and beliefs of individuals.	Based on the individual's behaviour there is resolute by her/his behavioural which itself determined by her/his attitudes as well as subjective norms towards the behaviour
THEORY OF PLANDED BEHAVIOUR (AJZEN 1985)	TPB theory was based on TRA which was developed by Ajazen (1985). TRA was linked with voluntary behaviour which clears not to be 100% voluntary in certain circumstances. As the results additionally another construct which perceived behavioural control.	It is based on the perceived behavioural which can control the individual's perception with regard to how difficult or easy for a specific behaviour is to perform.	The intention based on individual to perform the behaviour is determined by three areas which are subjective norms, attitudes and perceived behavioural control.
THE TECONOLOGY ACCEPTANCE MODEAL (DAVIES 1989)	TAM is an IT theory which describes how people can accept t and use technology. The study of TAM by Davis (1989) is based on adaptation the theory of TRA.	TAM related to two factors that can control individual's intention to apply and use an innovation technology; these are perceived useful and perceived ease of use.	The first stage is a personal behavioural intention to use a technology which is delicately influenced by both perceived usefulness as well as perceived ease of use.
DIFFUSION OF INNOVATIUONS (ROGERS 1995)	Diffusion is the steps that assimilating an innovation by the members of social systems who developed the theory over time and via certain communication channels.	There are five main characteristics which are relative advantage, complexity, compatibility, observability and trialbility.	Diffusion of innovation n based on five stage process which are knowledge, persuasion, decision, implementation and conformation.
TECONOLOGY ACCEPTANCE MODEL TAM2 (VENKATESH & DAVIES 2000)	It is an development of the theory of TAM which explained the two area including perceived usefulness and usage intentions in the terms of social influence as well as cognitive instrumental processes where the innovation was applied in both mandatory as well as setting.	There are seven factors that introduced in this theory which including subjective norm, experience, image, job relevance, output quality, result demonstrability as well as perceived ease of use).	The realty use of the system which directly influenced by behavioural intention to use this can turn is directly influenced by perceived useful and perceived ease of use.
UNIFIED THEORY OF ACCEPTANCE AND USE OF TECONOLOGY UTAUT (VENKATESH *ET AL* 2003)	UTAUT was reviewed and assimilating of the eight theories that early studied including the area of using technology and behaviour. The main target was to described users' intentions to use a technology as well as their sub sequent behaviour.	There are two main factors which including dependent constructers which has behavioural intention and usage behaviour. Additionally, independent constructers which based on performance expectancy, effort expectancy, social influenced, facilitating condition, gender, age experience and voluntariness of use.	The theory introduced the there were four key constructs which including performance expectancy, effort expectancy, social influence as well as facilitating condition which are direct determinants of usage intention and behaviour. The other facture are posted to moderate the impact of the four key constructs.

2.10 Diffusion of Health Care Innovation

Diffusion of Innovations of health care is a research model that describes how a new idea, product or positive health behaviour spreads through a community or social structure. The model identifies several factors that influence how quickly an idea or behaviour is adopted. The adoption of a new idea (or diffusion of innovation) depends on characteristics of the innovation, communication channels, time and the social system. This model highlights the uncertainties associated with new behaviours and helps public, and profit health program implementers consider ways to resolve these uncertainties.

Berwick (2003) points out that there are several critical success factors for the dissemination of healthcare innovation. Firstly, a formal mechanism to find sound innovations should be disseminated followed by finding and supporting innovators, as well as investing in early adopters. In addition, it also includes making early adopter activity observable so it can be trusted and, lastly, leading by example. Varkey notes that in healthcare, the best innovations may not be successful if the market or environment is not ready for adoption (Varkey *et al.*, 2008).

2.10.1 The Healthcare Innovation

One of the most critical aspects of innovations in health care is related to product, process, or structure (Varkey *et al.*, 2008). Healthcare innovation can be defined as "the introduction of a new concept, idea, service, process, or product aimed at improving treatment, diagnosis, education, outreach, prevention and research, and with the long-term goals of improving quality, safety, outcomes, efficiency and costs" (Omachonu and Einspruch, 2010, p.5). Furthermore, information technology remains a significant key driver of innovation in healthcare.

Gupta (2008) claims, while hospitals and other care providers have long been quick to adopt breakthrough technology in medical devices, procedures, and treatments, far less attention has focused on innovations in networking and communications. The reason behind this is that it is concerned with breaches of security and patient privacy and because of healthcare, until recently, was a service that was always performed locally and in person.

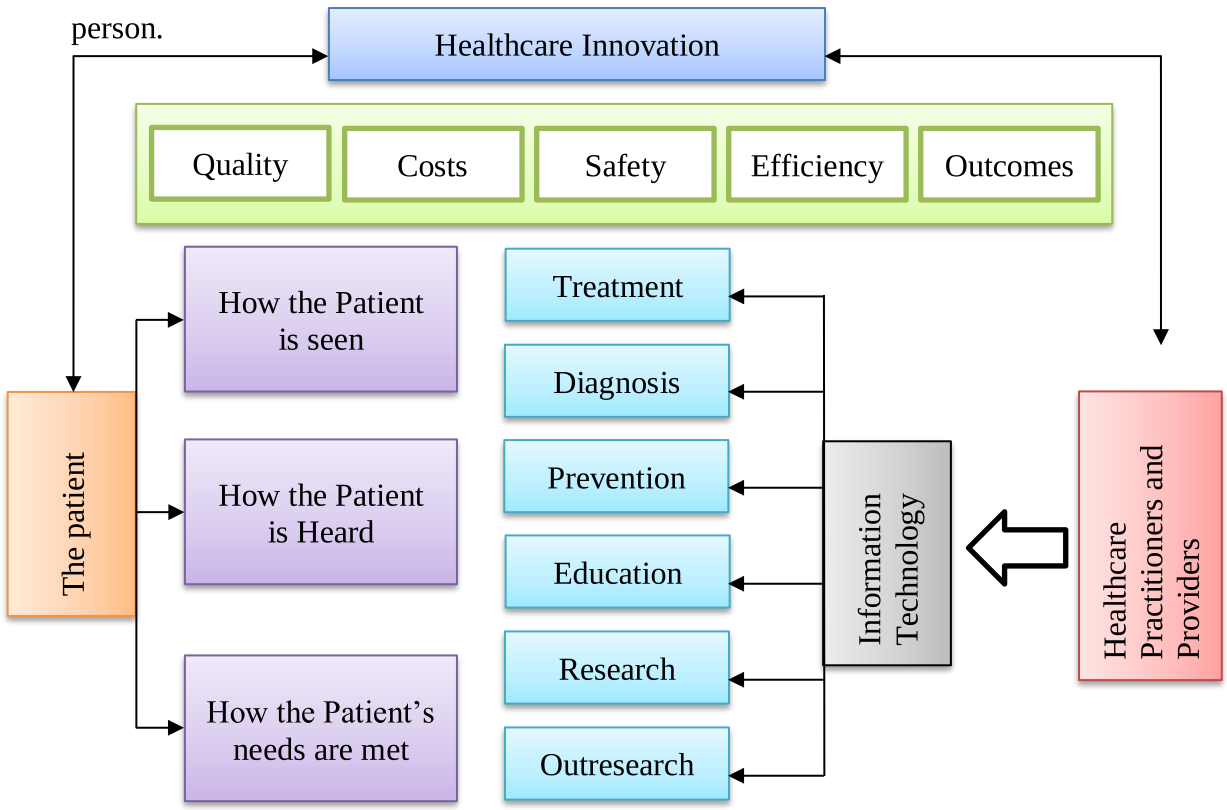

Figure 2-12 Conceptual Framework for Innovation in Healthcare (Omachonu and Einspruch, 2010, p.10).

As indicated by Figure 2-13, healthcare organisations serve six distinct purposes: treatment, diagnosis, prevention, education, research, and outreach. In serving these purposes, healthcare organisations must effectively manage quality, costs, safety, efficiency, and outcomes. At the very core of healthcare innovations are the needs of patients and the healthcare practitioners and providers who deliver care; healthcare organisations arrive at innovation by relying on new or existing information technology. When successful, healthcare innovation focuses on three areas: how the patient is seen, how the patient is heard, and how the patient's needs are met (Omachonu and Einspruch, 2010).

2.10.2 The Process of Healthcare Innovation

There are several studies involved in the investigation of healthcare innovations, but only a limited amount of studies focused on the actual process. According to Omachonu and Einspruch (2010), studies investigating innovations in healthcare have been initiated by following healthcare stakeholders (patients, affected-person advocacy groups, health organisations, physicians, and other health professionals). In a few cases, the government puts pressure on the healthcare organisations to change in order to mitigate healthcare concerns and challenges. If the need is recognised, the next challenge lies in determining whether the healthcare innovation maker can fulfil the necessity internally (Omachonu and Einspruch, 2010). If the innovation hails from within the health organisation, it is usually tested, modified, and adopted flexibly.

If the innovation does not originate from inside the healthcare organisation, the healthcare technology company should develop, examine, and market this technology to health organisations. In some cases, a health advancement company takes an imperfect test, refines it, and markets it to healthcare organisations. It is essential to understand the internal means of innovation within a health organisation like a hospital, nursing household, home health or managed Care Corporation. These organizations typically do not have the luxury of considerable research and development department and so must count on the ability and creativity of external staff (Omachonu and Einspruch, 2010).

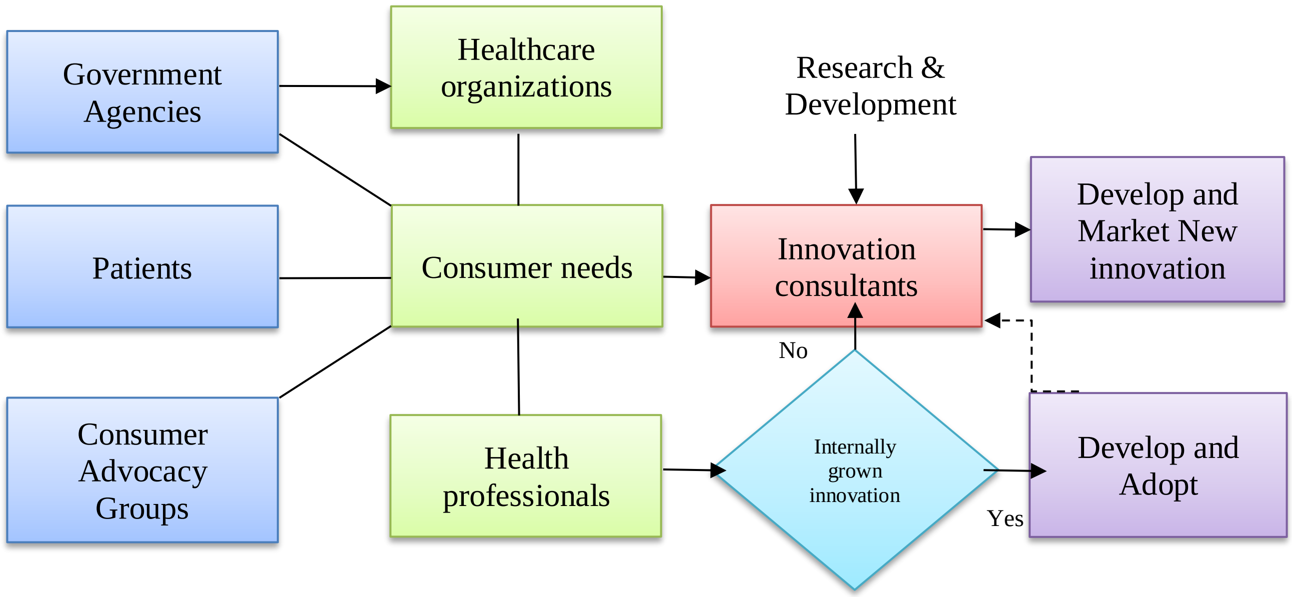

Figure 2-13: The process of healthcare innovation (Omachonu and Einspruch, 2010, p.36).

As the above figure describes, a managed-care company may rely on feedback from its sales and marketing field staff; a hospital might rely on feedback from patients, physicians, and staff; and both groups may rely on information regarding competitors to commence the search for improvement. In some cases, the limitations in the resources available to healthcare organisations force them to partner with a healthcare innovation company to create a product that meets their needs (Omachonu and Einspruch, 2010).

2.11 EHRs Integration

According to Coleman (2013), health information should be stored, managed, and transmitted in paper or electronic form exclusively within the hospital. Coleman (2013) illustrates the importance of the health organisations shall be sharing patient data between each other, especially between public and private hospitals. The connection of electronic health records between health organisations are essential; so, this will assist doctors making better therapeutic decisions which improve health services.

In cases of sharing health data between health care providers, there is a need to look at risks and barriers discussions from previous researchers related to EHRs. Indeed, there are several research concerns about privacy in relation to sharing health data. EHRs are used to facilitate electronic access to view the patient's health data, which enables practitioners to create, update, and share patient medical records (Angst and Agarwal, 2009; Blendon *et al.*, 2002; Sánchez *et al.*, 2005). Consequently, these systems are gradually replacing paper-based records, which can cause medical errors due to loss of papers or unclear handwriting (Blendon *et al.*, 2002). Although many healthcare organisations store patient health data in both computer-based and paper-based records, EHRs go beyond traditional standalone systems to assist in the sharing of health information among healthcare organisations. Additionally, to mitigate the risk of errors posed by paper-based records, there are additional benefits of EHRs, such as efficiency in accessing patients' information, capability to monitor patients' health over time, and providing patients with access to their medical record, which can empower them to be informed about their health for future improvement (Angst and Agarwal, 2009). According to Coleman (2013), sharing data between healthcare providers can improve a patient's health safety. It allows tracking of diseases that need to be statistically reported to governmental decision makers (Angst and Agarwal, 2009).

In Saudi Arabia, health care providers are categorised into two main groups: public-owned (government) hospitals and private-owned hospitals. Patients who go to public hospital have their health information kept exclusively in the government hospital database; patients who go to private hospital have their health data history stored without sharing with other health providers. Thus, patients who are moving from a private hospital to a public hospital, and vice versa, have no means of transferring their medical records. This may be due to the challenges in sharing data between private and public hospitals. According to Lohr and Donaldson (1994), data, especially financial health data, may be impossible to share with other providers.

2.12 HIMSS evaluation

HIMSS Analytics is an international healthcare adviser, which offers guidance and IT solutions for better E-health. HIMSS Analytics has designed the evaluation model to help both hospitals and health professional evaluate EMRs adoption through the EMRs Adoption Model (EMRAM). According to HIMSS Analytics, The Electronic Medical Record Adoption Model (EMRAM) is based on an eight-stage (0-7) model that processes the adoption and utilisation of EMR functions required to achieve a near paperless environment that harnesses technology to support optimised patient care (Hersh and Wright, 2008).

There are eight-stages (0-7) model measures and evaluating the adoption and utilisation of electronic medical record (EMR) functions. In Stage 0, the organisation has not adopted EHRs in the three most important departments, which are radiology, pharmacy, and laboratory. In Stage 1, all three main ancillaries' clinical systems are installed including laboratory, pharmacy, and radiology. In Stage 2, procedures for the three most important departments feed data to the Clinical Data Repository (CDR) that allows the clinical staff to access, for reviewing all orders and results. Also, the CDR can control medical vocabulary, as well as support making clinical decision engine (CDS) for basic conflict checking. At this stage also, the information from document imaging systems can be linked to the CDR. Moreover, the hospital organisation can be health information exchange (HIE) by sharing information that has in the CDR with other patient care stakeholders. In Stage 3, all clinical documentation is integrated with CDR for at least one inpatient service in the hospital. In this stage, the Electronic Medication Administration Record application (eMAR) is integrated with medical image access from picture archive and communication systems (PACS). This is available for access by physicians outside the Radiology department via the organisation's intranet. In Stage 4, Computerized Practitioner Order Entry (CPOE) is used to support clinical decisions to create orders with adding the nursing and CDR environment along with the second level of clinical decision support abilities linked with proof based medicine protocols. In Stage 5, the radiology PACS systems deliver medical images to health professionals via the website and connect all PCs with the Internet. At Stage 6, all health professional's documentation is stretched in templates with all health care functional online. All three levels of health care professional's closed-loop drug administration, which is, performed with a sufficiently encoded drug as well as environment drugs. Also, the eMAR and barcoding is implemented and more impolitely integrated with CPOE and pharmacy to improve care patient safety processes for medication administration.

Lastly, stage 7 is a fully electronic hospital that no longer uses paper in its activities. In this stage, EMRs are entirely electronically implemented including using medical images, document images, and discrete data online. Moreover, all data are electronically warehousing to improve health data security, which is extremely essential. Sharing data internally and externally is available online, and the hospital shows summary data continuity for all hospital services electronically (Hersh and Wright, 2008). The following table shows the stages of the model.

Stage	EMRs Adoption Model Evaluation and Cumulative Capabilities
Seven	Complete EMR, Data Analytics to improve care
Six	Physician Documentation (templates), Full CDSS, Closed Loop Medication Administration
Five	Full R-PACS
Four	CPOE; Clinical Decision Support (clinical protocols)
Three	Clinical Documentation, CDSS (error checking)
Two	CDR, Controlled Medical Vocabulary, CDS, HIE Capable
One	All Three Ancillaries Installed –Lab, Rad, Pharmacy
Zero	All Three Ancillaries Not Installed

Table 2-8: EMR Adoption Model Evaluation (Hersh and Wright, 2008, p.304).

2.13 The Gaps in the Literature

This chapter reiterates the dominant deficiencies in health information technology literature: research gaps relating to health care systems and HIT in Saudi Arabia; gaps relating to the factors, risks, barriers, and impacts on HIT-related EHRs; gaps relating to the theories behind the adoption of innovation; and an overview of the main deficiencies addressed in this research.

Using HIT in Saudi Arabia: There are two main categories of healthcare provider in Saudi Arabia private and public hospitals that are managed by the government via the MoH. There is a need for research to clarify whether EHRs link public-to-public, private-to-private, and private-to-public hospitals in Saudi Arabia. Furthermore, these links have never been studied and examined in a Saudi context, as the use of HIT-related EHRs has only recently been implemented. There is also needed to examine the critical impacts that influence the adoption of HIT-related EHRs. The literature review shows that links have yet to be established between the three main factors influencing the adoption of HIT-related EHRs: the technical, administrative, and social factors.

The impacts, barriers, and risks of the HIT: Many existing health information technology studies do not utilise validated measures of concern and do not even show the impacts, barriers, and risks of sharing health data between private and public hospitals electronically. Some recent studies have investigated the impact of using HIT-related EHRs in the USA, without clarifying whether the studies were based on private or public hospitals. This study presents the differences between the impacts on private and public hospitals, which have not yet been examined in the Saudi context.

Healthcare Innovation theories behind the adoption of innovation and technology adoption: This study combines other theories, including TAM, TPM, TRA, and UTAUT, which were presented in this chapter, and shows the main differences between them. The reason for reviewing these theories is that it allows the researcher to build a clearer picture of the research model for the adoption of HIT-related EHRs. This study also utilises a case study approach to develop deep insights into HIT-related EHR acceptance and adoption intentions, in particular between private and public hospitals.

The main gaps: There is a scarcity of comprehensive information technology studies across all contexts, including those in relation to health record systems. Thus, there is a need for a comprehensive study model encompassing the factors, impacts, and risks of HIT-related EHRs, and the concern-adoption relationship (as shown in Figure 2-14). There is also a need for studies that harness multiple theories to explain barriers in this context. There is a gap in the literature when it comes to studies that examine technologies introduced by health providers, such as EHRs, and technologies utilised by citizens, such as EHR integration applications.

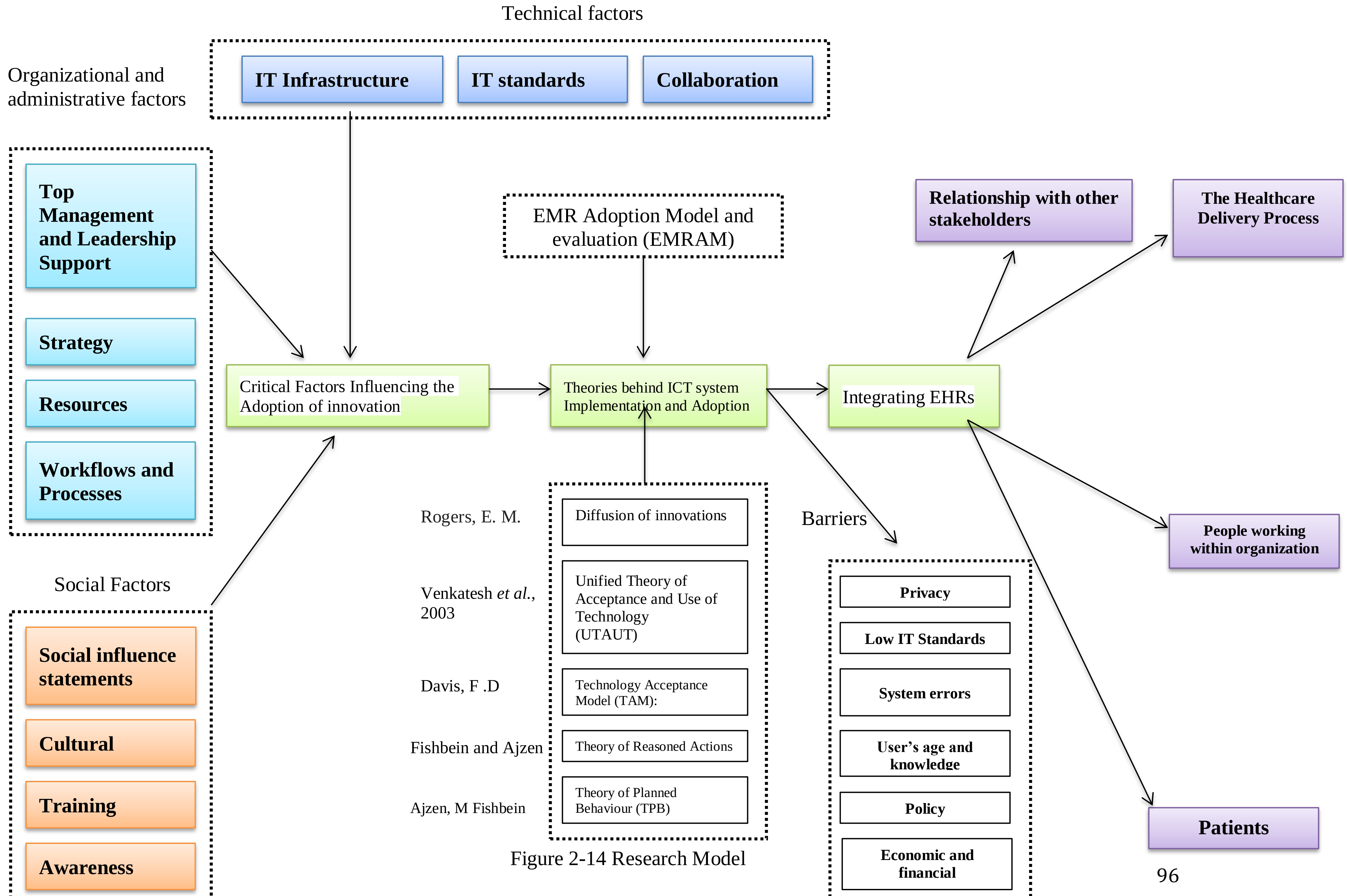

Figure 2-14 Research Model

2.14 Conclusion

This chapter reviewed the existing literature relating to the use of HIT-related EHRs/EMRs. As evidenced in this chapter and preceding discussion, gaps exist in the understanding of the role of HIT-related adoption, especially between private and public hospitals. This research aims to provide an initial step towards developing an assessment model for analysing the adoption of HIT-related EHRs in different healthcare organisations. A qualitative method will be utilised, in the form of four case studies, focused on investigating subjective data, namely, the perceptions of research participants. The goal is to illuminate these perceptions and gain greater insight and knowledge. Health information technology in the literature centres broadly on three themes:

- The critical factors that influence the adoption of HIT-related EHRs/EMRs.
- The key impacts on the adoption of HIT-related EHRs/EMRs.
- The adoption model for HIT-related EHRs/EMRs.

These themes are linked herein to research questions, objectives, and gaps in order to investigate the organisational needs for adopting HIT-related EHRs/EMRs. Furthermore, health information technology, as a distinct research topic, commenced in earnest from the early 2000s. Over the past twenty years, the level of research in this area has been slowly growing, providing opportunities for many areas of further research.

Chapter Three: Research Methodology and Design

Figure 3-1 Chapter Structure

3.1 INTRODUCTION

3.2 RESEARCH OBJECTIVES

3.3 RESEARCH PHILOSOPHY
3.3.1 Positivism
3.3.2 Interpretivism

3.4 RESEARCH DESIGN

3.5 RESEARCH PARADIGM
3.5.1 Ontology
3.5.2 Epistemology

3.6 QUALITATIVE RESEARCH METHOD
3.6.1 Reasoning behind the Selection of Qualitative Research
3.6.2 Justifying the Use of the Case Study Methodology
3.6.3 Documentation

3.8 PARTICIPANTS SELECTION

3.9 CHOICE OF HEALTHCARE SECTORS

3.10 DATA COLLECTION
3.10.1 Structure of the interviews
3.10.2 Semi-structured interviews
3.10.3 Questions types
3.10.4 Pilot interview
3.10.5 Main Interviews:
3.10.6 Audio Recordings and Transcriptions
3.10.7 Contact summary sheet

3.11 DATA ANALYSIS
3.11.1 The coding process
3.11.1.1 Step one: Data reduction to create summary codes:
3.11.1.2 Step two: Using summary codes grouped to determine conceptual labels
3.11.1.3 Step three: Conceptual labels grouped with matches and relationships to create thematic codes
3.11.1.4 Step Four: Cross case study analysing

3.12 CONCLUSION

3.1 Introduction

The purpose of this chapter is to discuss the research philosophy adopted by the qualitative school of thought, and it will introduce the approach and the instruments utilized in the service the research goals. This chapter presents the research paradigm, design, and methodologies used to address the research gaps, followed by the design of the interview. It is obvious from the previous chapter that there are several research gaps in the current literature, in terms of comparative international research into the adoption, implementation, and evaluation of IT in the healthcare sector. There is, in particular, a lack of studies focusing on EHR/EMR systems. Furthermore, the processes of data collection and data analysis will be discussed, including a description of the software used to investigate the collected data. The chapter will then close with a summary.

This study seeks to contribute to a deeper understanding of the roles played by several actors within four hospitals, and the interaction between people and IT systems. This substantiates a need for a standard basis of comparison since the pre-existing body of research has used various sources of data, methods of research, and metrics. Additionally, it is recognized that there is a need to focus on EHR/EMR systems within acute care.

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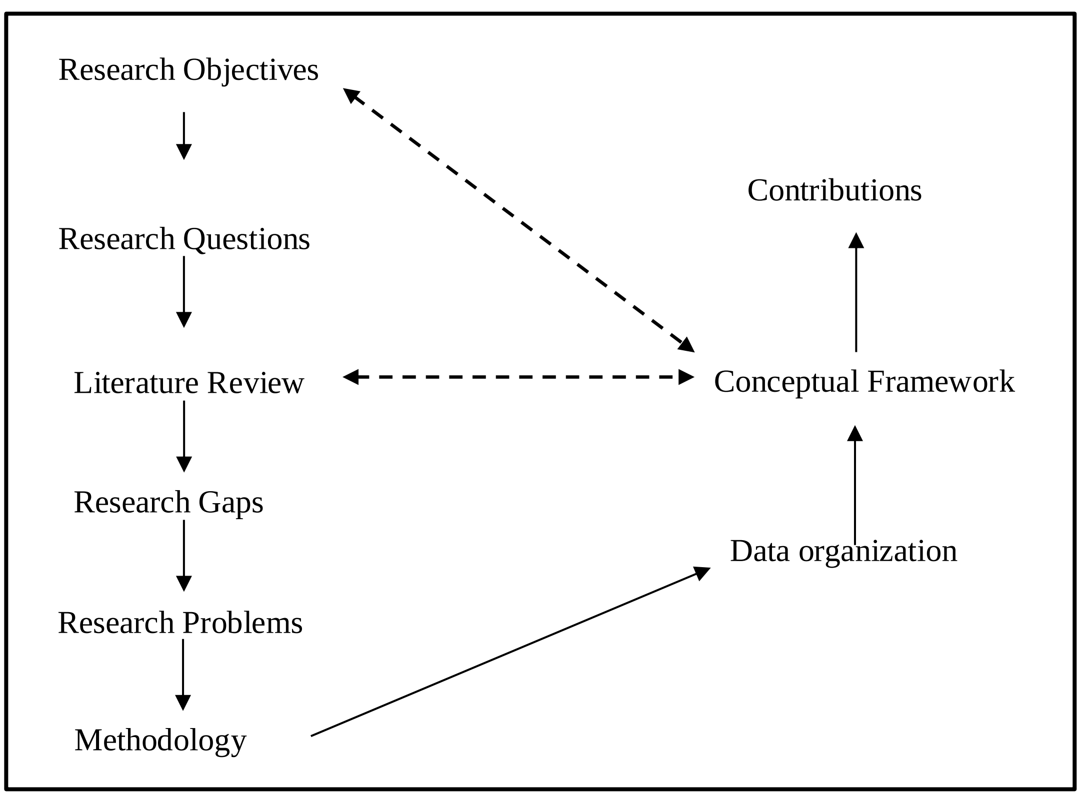
3.2 Research objectives

The main purpose of this study is to identify the key issues surrounding the development and implementation of HIT, and to evaluate how the adoption of EMRs influences the delivery of healthcare services in private and public hospitals. This is done through an analysis of how these systems affect the organisation and operations of these hospitals and the main people dealing with the system. The research undertakes a traditional review of the literature, followed by a qualitative case study methodology. This will allow for the examination of the current status and availability of EMRs in Saudi Arabia and the identification of the facilitator's health informatics, along with the barriers affecting EMR implementation. An additional objective will be to explore the initiatives undertaken by the MoH for EMR implementation and to outline its achievements, to date, in the adoption of EMRs. This study is structured according to the research framework below.

Figure 3-2: Research Framework



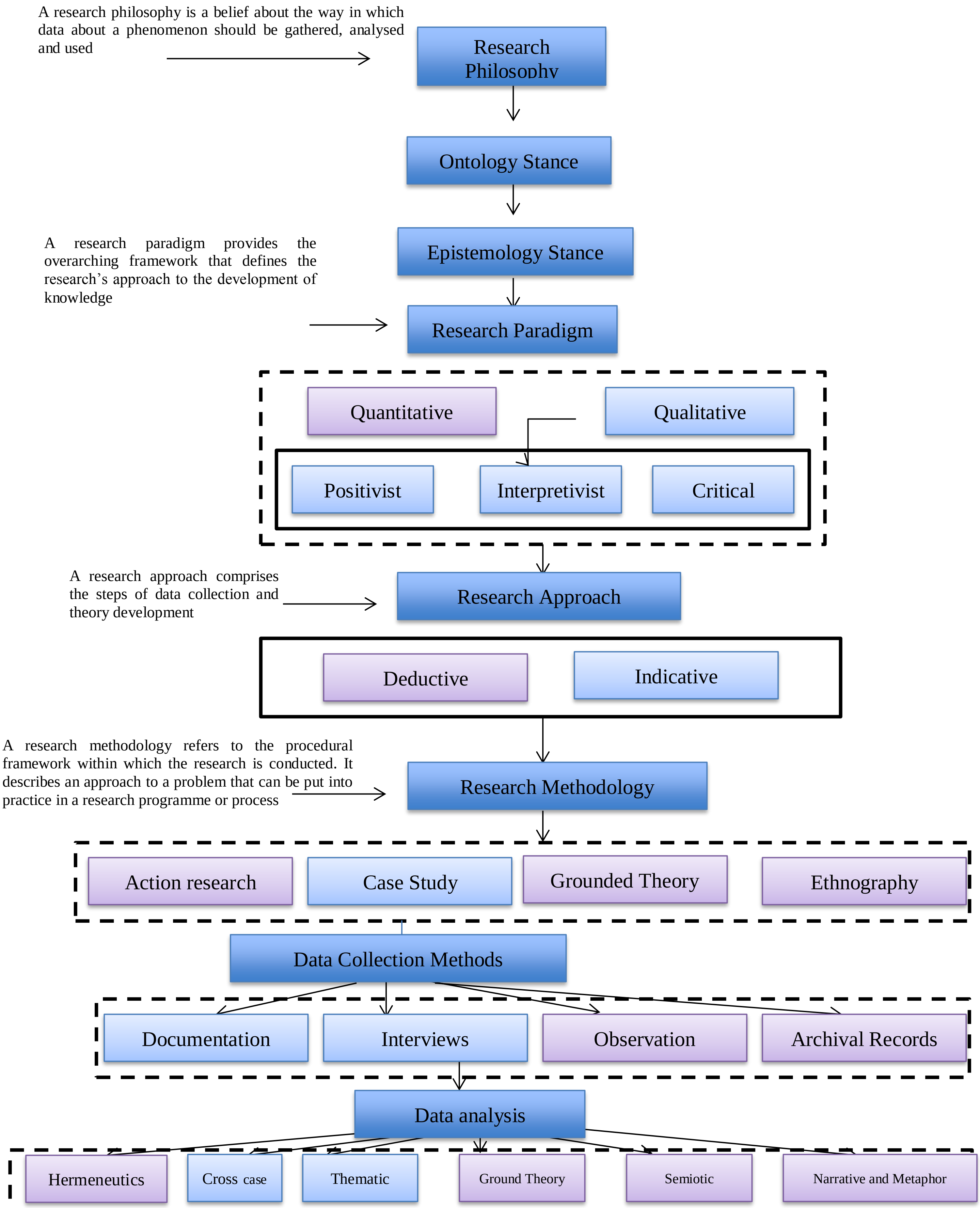


Figure 3-3: Theoretical research strategy framework and the selected options

3.3 Research philosophy

According to Coolican (2009), a research philosophy is perceived to be a belief concerned with the development of the knowledge in which data regarding the phenomenon is collected, analysed, and processed. Research centres on two major research beliefs: positivist and interpretivist. Blaxter *et al.* (2010) and Levin (1988) define positivist research as a paradigm which considers a phenomenon to be measurable by using analytical instruments such as surveys, and which is observable by experiments. On the other hand, an interpretivist approach focuses on the researcher's viewpoint for understanding the social reality rather than seeking generalizable truths (Given, 2008).

According to Depoy and Gitlin (2015), the main purpose of a research philosophy is to allow the study to define the knowledge necessary to address the research problem, and the approach needed to obtain, analyse, and interpret the information. Also, Saunders *et al.* (2011) point out that a research philosophy contains essential assumptions about the way the researcher views the world. These assumptions allow the researcher to decide on a research strategy and a method for the research. In other words, the research philosophy is the researcher's stance that was used for the study to examine objectively the research topic, which in this case, is the impact of EMRs/EHRs on both the private and public sectors in Saudi Arabia. The selection of this philosophical stance is related to the nature of the research questions.

3.3.1 Positivism

Positivist research epistemology is an approach that closely aligns with the position adopted in the natural sciences. Positivism is described as the belief that the social world exists independently of human actions and beliefs; it is illustrated by measurable variables that are independent of human actions and experience (Halaweh *et al.*, 2008). In contrast, interpretivism believes that science is subjective and can allow alternative models of reality, positivism argues that science is objective and emphasises exact measurement (Bharadwaj, 2000). Thus, a positivist approach usually includes the use of surveys, statistics, and quantitative data (Bernard and Bernard, 2012).

3.3.2 Interpretivism

In interpretivist philosophy, the view is taken that the environment is studied socially and that there is no reality outside of people's perception of an event (Veal, 2005). Interpretivism believes that issues should not be examined objectively and believe should be only decomposed into their core parts for study (Orlikowski and Baroudi, 1991). As such, the researcher believes that people who interact in a situation are significant for any description of factors and must be an essential part of the study (Orlikowski and Baroudi, 1991). Furthermore, the main philosophy of interpretive research acknowledges that the value, purpose, and background of the researcher will influence the results of the study (Neuman, 2000).The interpretive epistemology was used in this research to address the research questions because the nature of this research was such that the approaches and methods were more closely related to interpretivism than positivism. Indeed, given that the objectives of the research were to explore the perspectives of the impacts from a participation point of view, by using semi-structured interviews, which is an interpretive approach, interpretivism was deemed the most appropriate.

3.4 Research design

A research design is a framework; procedures and methods are used in the research study to collect and analyse data (Bryman, 2015; Churchill and Iacobucci, 2006). According to Yin (2003, p.1), the selection of the methodology relies on three aspects:

- The type of investigation question.
- The control an agent has over real behavioural situations.
- The attention that is on contemporary rather than historical phenomena.

There are several different types of research designs, such as meta-analytic, review, experimental, semi-experimental, correlational, and descriptive (Creswell, 2012). However, as the design is an arrangement of conditions or collections, this study is focused on a descriptive case study design method. There are many ways to classify research designs, but sometimes the distinction is artificial, and other times different designs are combined. This research focused on descriptive research, which describes the characteristics of a population or phenomenon being studied. This study does not answer questions about how/when/why the characteristics occurred. Rather, it addresses the "what" (Shields and Rangarajan, 2013).

There is a difference between flexible and fixed designs. Flexible designs afford researchers more freedom in collecting data. The main reason for the research design is illustrated through the qualitative research by focusing on the descriptive case study. Before the data collection of the case study started, it was necessary to identify the research design by choosing the descriptive method. It is difficult to know ahead of time which factors should be controlled and measured. Frequently, these variables are measured can be quantitative and qualitative (Robson, 1993). The overall research design is presented below.

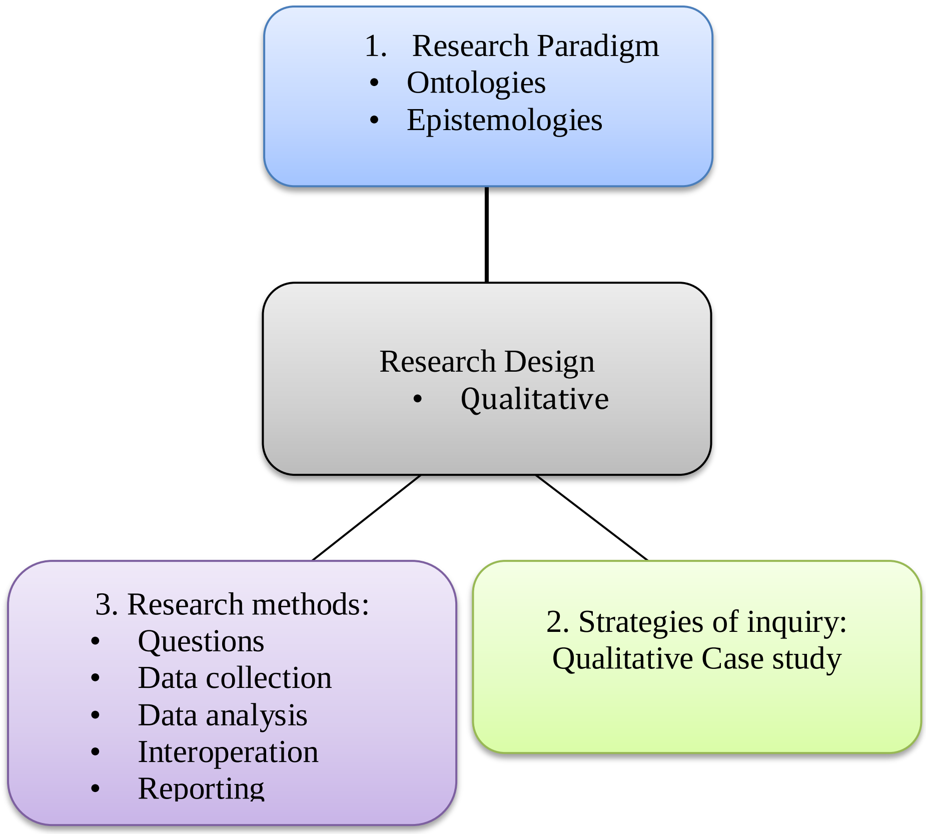


Figure 3-4: Research Design

The selection of the research design had to be suitable for empirical and subjective inquiry that investigates a contemporary phenomenon within a real-life context (Yin, 1994). Hence, the nature of HIT will have implications for the selection of a suitable methodology. In particular, it contains consideration of policies, structure, culture, and work relations. This involves understanding, beliefs, and values of individuals through which they take actions by describing their behaviours and attitudes at different organisational levels and assessing either objective or subjective standards. To investigate this, in health organisations in a Saudi context, this study takes a qualitative approach.

3.5 Research Paradigm

Research paradigm was first introduced by Kuhn (1962), to describe the way we look at the world. Additionally, Creswell (2013) described a research paradigm as a school of thought or a framework for thinking about the manner in which the research inquiry should be conducted to establish reality. There are two main research beliefs: positivist and interpretive, each of which can be clarified through ontological, epistemological and methodological positions in the design and context of the study (Guba and Lincoln, 1994). According to Guba (1990), paradigms can be characterized by their ontology (reality), epistemology (knowledge), and methodology.

3.5.1 Ontology

The term ontology is used to explain the nature of existence (Hornby and Wehmeier, 1995). There are two philosophical attitudes linked to reality. The first is objectivism and the second is subjectivism. Additionally, Avison and Fitzgerald interpreted both objectivism and subjectivism as realism and nominalism (Avison and Fitzgerald, 2003). However, objective ontology assumes that social and natural reality has an independent existence before human cognition. Participation using an objective ontology put themselves outside of this research and states do not influence the development of the research (Avison and Fitzgerald, 2003). Subjective research ontology, on the other hand, is based on reality exists in the communications between people and in the explanation of that reality. In the subjective ontology approach, the reality that people confront is the reality that they interpret. In this thesis, subjective ontology was used to explore the perceptions of the participants involved.

3.5.2 Epistemology

The concept of "Epistemology" is come from the two Greek words which are "episteme" knowledge and "logos" science, and that means the science of knowledge (Rev. John J and Toohey, 1952). According to Mason and Mcbride (2014), epistemology means the science of the certitude of human knowledge. The material object of Epistemology is human knowledge, and it sources the formal object of epistemology is the certitude of human knowledge. Also, Epistemological is described as assumptions concerned with the nature of knowledge and the methods of actions used in acquiring such knowledge (Iivari *et al.*, 1998).

Epistemology is also described as Applied Logic, Material Logic, Major Logic, Critical Logic, Criteriology, and Fundamental Philosophy. Since the name logic without qualification is now very normally applied to the science of valid argument, it can hardly be regarded as an excellent reputation for the science of certitude. Ticehurst and Veal defined the term epistemology as approaches and methods (Ticehurst and Veal, 2000). There are two main epistemological stances, which can be used in business research, these being positivism and interpretivism.

3.6 Qualitative Research Method

This research seeks to explore human reactions to the adoption of EMRs/EHRs by using only qualitative methods. Both Denzin and Lincoln (2005) describe qualitative research as a multi-method in focus, involving an interpretive, and naturalistic approach to its subject matter. In other words, qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena regarding the meanings people bring to them. Creswell (2012) defined qualitative research as “an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyses words, reports detailed views of informants and conducts the study in a natural setting” (Creswell, 2012, p.15).

According to Denzin and Lincoln (2005), qualitative research involves the studied use and collection of a variety of empirical materials, personal experiences, introspectives, life story interviews, and observational, historical, interactional, and visual texts that describe every day and problematic moments and meaning in individuals' lives. Additionally, the study of Merriam (2002) notes eight types of qualitative research:

- **Basic interpretive qualitative study:** a basic interpretative qualitative study is used when the goal of the researcher is to understand how participants make meaning of a situation or a phenomenon.
- **Phenomenology**: a phenomenological study focuses on the essence or structure of an experience.
- **Grounded theory**: grounded theory has as its goal the development of theory through inductive approaches. The theory is “grounded” in the data. Secondary concerns are a discovery with description and verification.

- **Case study:** the case study is an exhaustive description and analysis of a phenomenon or social units such as an individual, group, institution, or community. The case is a limited, and integrated system. Because the unit of analysis defines the case study, this approach is sometimes combined with other types of qualitative methods.
- **Ethnographic study:** ethnography was developed by anthropologists to study human society and culture. In a qualitative ethnographic study, data is interpreted from a sociocultural perspective.
- **Narrative analysis:** in narrative analysis, first-person accounts in story form, biography, autobiography, life history, oral history, autoethnography, and life narratives are used in data analysis.
- **Critical qualitative research:** critical qualitative research uncovers, examines, and critiques the social, cultural, and psychological assumptions that structure and limit our ways of thinking and being in the world.
- **Postmodern research**: postmodern is the newest form of qualitative research, and it challenges other types. It grows out of the postmodern movement that challenges the routine of the modern world with its emphasis on a reality that is predictable and scientific.

As shown above, this research implemented a qualitative approach and considered case study as a methodology. This was mainly due to the strength of the case study in answering ‘how’ questions and providing an in-depth understanding of phenomena, as widely described by Yin (2003).

Structured interviews were considered an appropriate technique for extracting comparable findings, as echoed by Kothari (2004). The study focused on four Saudi hospitals, both private and public, to provide in-depth perspectives on the impact of HIT-related EMRs/EHRs on Saudi healthcare organisations.

3.6.1 The Reasoning behind the Selection of Qualitative Research

The majority of anthropology and social science scholars use qualitative methods rather than quantitative methods. Qualitative research "is well suited for description, interpretation, and explanation" (Lee, Mitchell, and Sablynski, 1999, p. 164); the reason for choosing a qualitative methodology revolves primarily around the type of question, or problem explored. Questions that begin with 'how' or 'what' lend themselves to a more qualitative study (Lee *et al.*, 1999), whereas questions about 'why' are more appropriately approached from a quantitative perspective (Creswell, 1998). The 'how' or 'what' questions arise because little is known about the problem or phenomenon being studied (Hoepfl, 1997; Nasser, 2001). Either no theory exists, or the existing theory is underdeveloped and cannot explain a phenomenon adequately (Merriam, 2002; Nasser, 2001).

According to Crano *et al.* (2014), qualitative, particularly descriptive research, can suggest possible relationships, causes, effects, and dynamic processes. Thus, this study applied qualitative research focused on the descriptive case study method, which is the type of a research methodology, to help draw a picture of causes and effects of EHRs/EMRs on healthcare systems.

3.6.2 Justifying the Use of the Case Study Methodology

There are critical articles justifying the case study approach. However, most of the scholars agreed that there is no doubt the case studies are widely used in the social sciences and organisational studies. The qualitative case study is described as an approach to research that helps in the exploration of a phenomenon within its context using a variety of data source (Baxter and Jack, 2008). Both Robert and Yin illustrated the two most critical key approaches to guide case study methodology. Both Forchuk and Roberts (1993) agree that a case study methodology is used to ensure that the topic of interest is well explored and that the essence of the phenomenon is revealed.

According to Yin (2003), a case study is designed, to consider "how" and "why" type questions; when it cannot manipulate the behaviour of those involved in the study; when it wants to cover contextual conditions because it believes they are relevant to the phenomenon under study; and when the boundaries are not clear between the phenomenon and context. The most common types of case studies are provided in the following table.

Case Study Types	**Definitions**	**Resources**
Explanatory	"This type of case study would be used if you were seeking to answer a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. In evaluation language, the explanations would link program implementation with program effects."	(Yin, 2003), (Joia, 2002)
Descriptive	"This type of case study is used to describe an intervention or phenomenon and the real-life context in which it occurred."	(Tolson *et al.*, 2002) moreover, (Yin, 2003)
Exploratory	"This type of case study is used to explore those situations in which the intervention being evaluated has no clear, single set of outcomes."	(Yin, 2003) moreover, (Lotzkar and Bottorff, 2001)
Multiple-case studies	"A multiple case study enables the researcher to explore differences within and between cases. The goal is to replicate findings across cases. Because comparisons will be drawn, it is imperative that the cases be chosen carefully so that the researcher can predict similar results across cases, or predict different results based on a theory."	(Campbell and Ahrens, 1998) moreover, (Yin, 2003)
Intrinsic	"It is used the term intrinsic and suggests that researchers who have a genuine interest in the case should use this approach when the intent is to understand the case better. It is not undertaken primarily because the case represents other cases or because it illustrates a particular trait or problem, but because in all its particularity and ordinariness, the case itself is of interest. The purpose is NOT to come to understand some abstract construct or general phenomenon. The purpose is NOT to build theory."	(Stake, 1995) moreover, (Hellström *et al.*, 2005)
Instrumental	"Is used to accomplish something other than understanding a particular situation. It provides insight into an issue or helps to refine a theory. The case is of secondary interest; it plays a supportive role, facilitating our understanding of something else. The case is often looked at in depth, its contexts scrutinised, its ordinary activities detailed, and because it helps the researcher pursue the outside interest. The case may or may not be seen as typical of other cases."	(Stake, 1995) Moreover, (Luck *et al.*, 2007)
Collective	"Collective case studies are similar in nature and description to multiple case studies."	(Yin, 2003) Moreover, (Scheib, 2003)

Table 3-1: The most common types of case studies

The case study approach can be single or multiple. According to Jackson (2001), a multiple-case study is appropriate when the purpose of the study is to improve theory which permits cross-case analysis, an essential feature if the developed theory is to allow broad generalisations. However, in this study, a multiple case study approach was used including four case studies. Yin (2003) identified the following: direct observation of activities and phenomena and their environment; indirect observation or measurement of process related phenomena; interviews - structured or unstructured; documentation, such as written, printed or electronic information about the company and its operations - newspaper cuttings, records and charts about previous use of technology relevant to the case.

Regarding the number of cases needed for the researcher to carry out the research inquiry, the literature is still narrow regarding suggesting the number of cases required to do so; so, this is usually determined intuitively (Irani, 1998). For instance, Dyer and Wilkins (1991) justified that the number of cases depends on how much is known about the phenomenon itself and what new information is likely to emerge from studying further cases. Eisenhardt (1989) recommended a multiple-case approach of at least four cases (no more than ten), while (Gable, 1994) mentioned that multiple inquiries should include up to five organisations.

In this study, the researcher has used four case studies, of both private and public hospitals in Saudi Arabia.

3.6.3 Documentation

There is no doubt that documentation plays a significant role in any data collection that uses the case study methodology. It is mostly used to support and augment evidence from other resources. Looking at Yin (2003) study, there are several main reasons for using corroboration and augmentation from other sources:

- Confirming the spelling and titles of organisations.
- Keeping specific details that can support the verbal accounts of informants.
- Setting the context for interviews or discussions within the organisation being studied.

According to Yin (2003), this category of evidence can take many forms, such as reports of events, letters, organisational records and newspaper clippings; therefore, documentation should be the object of specific data collection plans. For the primary purpose of this research, different documentation was collected as long as the sources were available to the researcher. These included, for instance, Ministry of Health reports and EMRs project reports, EMRs strategic plans, and HIT strategic plans. Furthermore, it is important to mention that all the organisations' websites were carefully examined as the main source of documentary material.

Furthermore, the researcher used the NVivo software to manage data. NVivo software can be described as a qualitative data analysis (QDA) software package that allows users to import, sort and analyse rich text and plain text documents, audio files, spreadsheets, databases, digital photos, documents, PDFs, bibliographical data, web pages and social media data.

There are key features of using NVivo, which are:

- Collecting and importing data.
- Organizing, classifying and coding data.
- Adding interpretations and notes.
- Querying and searching data.
- Visualizing data with models, maps, and graphs.
- Sharing findings.

In addition, NVivo helped the researcher to create an auditable footprint. It was used to enhance the transparency of the research process in conducting and interpreting the qualitative data. Using NVivo, new opportunities are offered in the process of analysing data, which are helpful in the development of explanations. In this research, the researcher can use any of the tools in NVivo to tease out themes from the data. It also allows the researcher to be aware that constant reflection on the participants' transcripts, to re-examine and confirm certain aspects, is essential.

3.7 Ethical compliance

The researcher gained approval from the University Research Ethics Committee (REC) before the research was conducted. According to Neuman (2000), data from other sources is often confidential. Thus, it brings with it certain legal and ethical issues. Two ethical reviews were approved by both DCU and the MoH, which are shown in Appendices A and B.

3.8 Participants Selection

The primary step was to identify potential healthcare sectors in Saudi Arabia, mentioned in chapter two. The second step was to identify appropriate criteria to guide participation selection. The last step was to establish how these healthcare employees were to be invited to participate in this research. The researcher selected twenty participants from different management level, as it was important to analyse the impact of EMRs on all management levels, in both private and public hospitals. There are three main organisational levels: top, middle, and operational (Koontz, 2010).

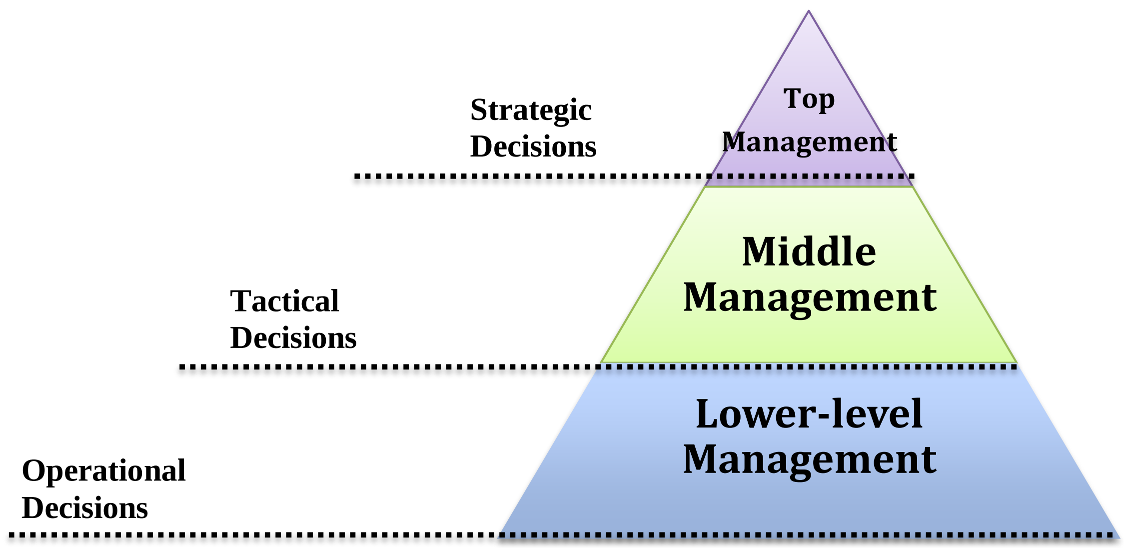


Figure 3-5: The management levels by (Koontz, 2010, p.4)

Twenty participants were interviewed for this research, all of whom work full-time as administration and clinical staff, with an average of six years' experience. To protect the confidentiality of these participants, no names were used. Each participant had a code, which contained the first letter of his/her organisation name and a number. As the interview questions did not require any technical knowledge of using a HIT, the interviewees answered according to their knowledge of the system, based on their basic use of it.

It is important to highlight that information systems in healthcare are shared by administrative and clinical medical staff. The researcher had to interview both staff groups to map a complete picture of users in relation to EMRs. The motivation for the choices made in selecting hospitals was based on the size of the hospital and the data access. The research received ethical approval as well as a letter from MoH allowing access. Furthermore, the top managers who made the arrangements based on the availability of participants suggested the selection of the individuals to be interviewed.

EHRs/EMRs divide responsibilities between administrative and clinical staff. The functional tasks for administrative staff are adding personal data, activity measurement, billing, managing personal data for statistics, general accounting, managing patient records, answering phones, making appointments, and maintaining the front desk/reception area. An administrator is responsible for ensuring that the business side of the practice operates efficiently. On the other hand, the clinical medical staff focuses on the patient care aspects of the practice. Their responsibility should be to prepare patients for medical exams, perform minor treatments, assist with exams, document medical histories, take vital signs, write diagnosis reports, write prescriptions, and instruct patients on home care. Thus, this study put forward interview questions based on the functional tasks among administrative and clinical medical staff at different management levels.

3.9 Choice of healthcare sectors

In the early 1950s, health services in Saudi Arabia began with fewer than 100 hospital beds. However, today healthcare has a total government budget of more than SAR 113 billion (Hasanain et al., 2014a). The total number of hospitals is 387; some of these hospitals are advanced medicinal healthcare organisations, which provide a variety of sophisticated treatments such as open-heart surgery, kidney transplants, and cancer therapies.

The first sources of data collection for this research were all healthcare sectors including private and public health care centres. Since the interviews were relevant to EMR impacts, all management levels in both private and public hospitals in Saudi Arabia were targeted for this research.

3.10 Data Collection

This section will provide the strategies and a data collection method used for this research, and includes the following aspects:

- Structure of the interviews
- Semi-structured interviews
- Questions type
- Pilot interview
- Main interviews

3.10.1 Structure of the interviews

The main aim was to develop the quality of the data by using open-ended questions. In this case, the researcher gives the participants a chance to talk freely and answer. The research consisted of a series of semi-structured interviews determining the impact of HIT on Saudi healthcare systems.

According to Neuman (2000), the scientific research investigates the following:

- It seeks answers to a question.
- Uses a predefined set of procedures to answer the question.
- It brings together evidence.
- Greatest analysing that was not determined in advance.
- Generates analyses that are applicable beyond the immediate boundaries of the study.

The use of qualitative methods enabled the researcher to explore the situation more in-depth for some participants. By undertaking interviews and then analysing the data, it was possible to determine the impact of HIT-related EMRs on Saudi healthcare systems (see Appendix D for interview structure).

3.10.2 Semi-structured interviews

Semi-structured interviews fall between a structured interview and unstructured interview. Two elements are chartered by interviews. In Guba and Lincoln (1994) studies, it is claimed that the first factor is the availability of previous knowledge, which should be used to help the formulation of questions (Sampson, 2004). The second factor is the amount of insight one has into how much one does know. Additionally, both of Guba and Lincoln agreed that these factors and their interrelationship could determine the suitable interview type regarding the research situation (Sampson, 2004).

For this research, the researcher had to construct general questions based on exanimating the impact of HIT-related EMRs on Saudi health care systems and the management knowledge of the interviewee. Semi-structured interviews were used to encourage participants to provide their views. A pre-prepared interview guide was used to ensure that the interview retains focus and enable the interview to be completed in the requirement frame. The results of the pilot interview were some necessary changes appeared in the format of the interview guide. These kinds of interviews were used in this research to allow them to remain within the region of inquiry. Moreover, they help to gain richness of the information to facilitate the process.

3.10.3 Question types

The interview guide offered a solid opening point, providing a map for the researcher to follow. According to March and Shapira (1987), it is recommended that questions be clear and to the point; using clear, unambiguous language helps provide a definite answer. This method was used for the interviewees, so they could fully understand the questions without more descriptions. Additionally, clear questions can assist collecting the data transparently. Open questions were used for the data collection due to the nature of the research. These questions often start with what, why, when, and who; it could use a statement such as "tell us about" and "give us an example". These sorts of examples of questions can provide the researcher with a good deal of information about the nature of management in healthcare sectors. There were some specific questions, which were used to determine facts. For instance, the researcher could ask: "what do you think about" and "how much do you spend on that". There was also probing questions, when appropriate. The probing questions help the researcher to explore deeper meanings (Sampson, 2004).

3.10.4 Pilot interview

An initial pilot interview was conducted after the final interview questions were drafted and checked by the supervisor. There is an advantage of the piloting process. It is assisted to review the questions and guarantee that they were easily understood. Moreover, it helps to ensure the quality of the data (Sampson, 2004). The main purpose of using a pilot interview in this research was to ensure that there was enough time for asking all the questions as well as assess the clarity of the interview questions.

Three pilot interviews were scheduled to take place. The first pilot interview was face to face after finishing the literature review chapter and ethical approval from University Research Ethics Committee (REC). The participation was interviewed on-site at his office, and the participant had more than ten years' experience in the IT healthcare. Furthermore, the main advantage of the pilot interview was for the researcher to determine the time of the interview. In the pilot interview, the researchers found that time taken was approximately 30 minutes and that the questions used, could be improved and more specific and clear.

The second pilot was via phone to make sure the researcher had the skills and ability to undertake a telephone interview. It was approximately 27 minutes' duration. The last pilot interview was held in Madinah after editing and reorganising of the questions. As the participations interviewed were small hospitals, this size of the organisation made it relatively easy to make appointments for interviews.

3.10.5 Main Interviews

The main interviews were organised with the participants via phone/email and arranged for a suitable time for face-to-face interview. This was usually scheduled a week or two ahead. Telephone contact made it relatively easy to communicate with the participants, to agree to be interviewed in their hospitals. Arranging to interview the participants at their hospitals or work meant that they did not have to leave their workplace; the fact that the interview was average 30 minutes also helped entice participants to the study.

Based on the organisation's case studies, the researcher selected a purposive sample, which included each type of staff profile - medical, clinical, nurses, and administrative. In addition, some of the interviewees were selected particularly for their ability. The reason behind that is to shed light on a particular aspect of the behaviour under investigation. These included the head of the IT department.

Some interviewees were gathered through a private respondent being used as an informant to identify others with previously defined characteristics that would suit the interview study profile, those with experience working with EMRs. Most of the interviews were with IT staff. However, there were several interviews with clinical staff. The researcher found that participants with a different point of view make the data richer.

Participants were provided with a copy of the consent form, which they signed. They were also assured that the interview was being conducted according to University Research Ethics Committee (REC) guidelines and that the interviews would be confidential.

3.10.6 Audio Recordings and Transcriptions

All interviews were digitally recorded on a mobile phone after participant approval was given. This gave the researcher the chance to capture the information with a high level of accuracy. Additional notes were also taken. The interviews were recorded and the researcher transcribed them within a few days. The interviews were in English and Arabic, which were translated and transcribed by the research and approved by supervisors and the interviewers. This transcription was required by the researcher to develop a general idea about each interview and reduce any errors in the transcriptions. The technique was used to ensure the integrity of the data so that there was no ambiguity or confusion regarding comments made in the interviews.

3.10.7 Contact summary sheet

A contact summary sheet was used to ensure that data collected via interviews were interpreted within the original context to avoid misinterpretation of the data during the process of analysis. Additionally, using the contact summary sheet to record details of each interview contact encapsulated contextual information was necessary.

3.11 Data analysis

Once the initial data was obtained from the structured and semi-structured interviews and transcribed, the data analysis began. This section illustrates the approach used to analyse the data collected. To achieve this objective, the data was analysed using cross-case and thematic approaches. The main purpose of the thematic approach is to create themes derived from data to understand the social context. The data analysis technique and strategy, which was adopted in this research, was established by using coding.

The primary intention of coding in qualitative research is to divide the data, then manipulate it into groupings that can be compared and regrouped to improve the approach (Strauss and Corbin, 1990).

In the thematic approach, three stages of coding were used. However, there are steps of analysis in each stage in coding. It will be provided initially relating to the data from the participation. The purpose of using coding was to help the researcher identify what data was significant and assign it meaning.

3.11.1 The coding processes

Coding is a useful tool to categorise rather than quantify data, and the raw data was organised into conceptual categories and themes or concepts in the coding process. The coding process deconstructs the data into discrete parts that are called summary codes, by asking questions and making comparisons. Similar events called concepts were grouped to form categories and themes, where their properties and dimensions could be examined.

The coding process is about conceptualising the data (Strauss and Corbin, 1990). It was followed by reconstructing data to understand details, re-organise/construct data to find the interrelationships and compare data with themes/concepts. This results in the outcomes being grouped in the data (Strauss and Corbin, 1990).

For this research, the data collected from the twenty interviews were transcribed into a word document that displayed line numbers. They were then copied to an Excel table. A summary of the four steps used in the coding process is provided:

- Data reduction to create summary codes.
- Using summary codes grouped to determine conceptual labels.
- Conceptual labels grouped with matches and relationships to create thematic codes.
- The cross-case study analysing.

3.11.1.1 *Step one: Data reduction to create summary codes*

The initial coding process organised the data into themes for analysis. This was undertaken by printing hard copies of the transcripts and summarising the data into summary codes. The data was analysed sentence by sentence, and an appropriate code was recorded in the adjacent column on the created word document.

When the initial open coding process was completed, each line was numbered according to the interview transcripts to link the codes with the data. This approach was taken concerning field notes in phase one and the semi-structured interviews; "Reducing the raw information may not result in few pages or fewer lines but will give it shorten "line" from, easier for comparison across units of analysis" (Boyatzis, 1998).

This step aimed to reduce the volume of data by highlighting the critical data with the main categories. All data relating to the research questions were highlighted on the transcripts. This was done a line by line and with comments and illustrated by specific words. An example of the coding process is shown in Appendix F.

3.11.1.2 ***Step two: Using summary codes grouped to determine conceptual labels***

Open coding is the first step of coding as an attempt to summarise the mass of data into categories, by reading the data, locating themes, and assigning initial codes or labels. Analysing is concerned with examining, comparing, categorising and describing phenomena found in the text (Halaweh *et al.*, 2008). It is actualised by starting a unit of analysis which could be either line by line or word by word, to focus on the main ideas of a sentence or paragraph (Halaweh *et al.*, 2008). The purpose of this coding was to structure the transcript of an event, object or action.

The initial coding process aimed to create conceptual labels from the summary codes to represent the phenomena. The conceptual labels were grouped into themes or categories using a group name. In addition, the themes were used to examine the data and to allow the researcher to analyse the data, to identify any new relationships or links between the conceptual labels (Strauss and Corbin, 1990).

This grouping of themes derived from the conceptual labels is a major step in the coding process, as described by Boyatzis. "At this stage in the analysis, there is less concern for a detailed, precise description of the theme and more concern for recording any glimmer of themes or patterns" (Boyatzis 1998, p. 86). An Excel spreadsheet was used for determining the conceptual labels. For example, an input from the summary codes step was "external impacts". This provided an analysis of themes codes for the last step in Excel, which is shown in Appendix G.

3.11.1.3 Step three: Conceptual labels grouped with matches and relationships to create thematic

In this step, the outcome of the open coding was that there were a large number of preliminary conceptual labels. To complete the coding, process the conceptual labels were analysed to determine the links and relationships between them to determine the final themes. This resulted in the number of conceptual labels being reduced down to fewer codes.

This step aimed to achieve the level of comparing themes that focus on similarities or differences to facilities further grouping. When these were illustrated, the themes were then rewritten, resulting in the thematic codes. To conclude, the process coding, the research method followed the cross-case approach to obtain the data and analyses that included codes, conceptual labels, and thematic themes.

3.11.1.4 Step Four: Cross case study analysis

The final step of the data analysing process was the cross-case analysis, which categorised common and different findings across the four hospitals. Each case study started with background about the EMR system that is currently adopted, which investigates the challenges, impacts, and factors that influence the adoption of health technologies. Miles and Huberman (1994) defined cross-case analysis as the methodology of synthesising and comparing two or more instrumental research cases.

According to Miles and Huberman (1994), cross-case analysis searches for outlines, similarities, and related factors and compares result measures. Yin (2009) stated that cross-case synthesis should contain at least two cases and that the selected cases could be conducted as independent studies, authored by different researchers or as predesigned parts of a single study. This study carried out a cross-case analysis after a critical reading of the four compiled case studies, twenty narratives, and the original case study interview transcripts. The analytic processes were similar to the individual case analysis in that data from these sources were again grouped into themes. These themes, conducted using the cross-case analysis, focused on comparing the point of view of adopting EHRs/EMRs. The purpose of a cross-case study analysis was to make comparisons and therefore identify the key findings across the case studies and examine discrepancies and their contributing factors. Additionally, the cross-case study analysis was developing critical findings and supporting the discussion of the research theories and framework.

3.12 Conclusion

This chapter explained the methodological stance taken by this research, to address the research questions mentioned in chapter one. The research method was described in detail, seen through a theoretical research strategy model in Figure 3-3. This framework begins with the research philosophy, which was based on the philosophical assumptions regarding the area of ontology and epistemology. Following this, an interpretivist approach was taken, looking at cultural, technical, and social problems concerned with using HIT-related EHRs/EMRs. After that, this chapter justified the main method chosen to gather data, a qualitative method, focusing more on inductive approach. The main method used to collect data was an in-depth interview, semi-structured in its format, interviewing participants from four case studies. Data analysis methods were then discussed data reduction, coding, conceptual labels, and cross-case study analysis. The following chapter will be presented the results in more detail.

Chapter four: Data Analysis and Findings

Figure 4-1 Chapter Structure

4.1 INTRODUCTION

4.2 Saudi Arabian healthcare systems

4.3 OHUD HOSPITAL CASE STUDY
4.3.1 Background
4.3.2 The interviews results
4.3.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs
4.3.2.2 Theme two: the impacts of HIT-related EMRs on health care
4.3.2.3 Theme three: the model of adoption EMRs

4.4 KING FAHAD HOSPITAL CASE STUDY
4.4.1 Background
4.4.2 The interview results:
4.4.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs
4.4.2.2 Theme two: the impacts of HIT-related EMRs on health care
4.4.2.3 Theme three: the model of adoption EMRs

4.5 SAUDI GERMAN HOSPITAL CASE STUDY
4.5.1 Background
4.5.2 The interview results:
4.5.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs.
4.5.2.2 Theme two: the impacts of HIT-related EMRs on health care
4.5.2.3 Theme three: the model of adoption EMRs

4.6 MOUWASAT HOSPITAL CASE STUDY
4.6.1 Background
4.6.2 The interview results:
4.6.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs
4.6.2.2 Theme two: the impacts of HIT-related EMRs on health care
4.6.2.3 Theme three: the model of adoption EMRs

4.7 CROSS CASE STUDIES ANALYSIS AND FINDINGS
4.7.1 Theme one: the critical factors influencing the adoption of HIT-related EMR Technical
4.7.2 Theme two: the impacts of HIT-related EMRs on health care
4.7.3 Theme three: the model of adoption EMRs

4.8 CONCLUSION

4.1 Introduction

This chapter focuses on the analysing qualitative data and findings collected via interviews in Saudi Arabia, in the Al-Madinah Al-Munawarah region, for both private and public hospitals. This qualitative data was analysed through four case studies, two private hospitals and two public hospitals. There were two main aims. Firstly, to gain a deeper understanding of each structure in the research framework. The second aim was to explore the situation of HIT in both private and public hospitals. The chapter is presented in four sections, which include the four cases. Moreover, the chapter will also provide a background for each health organisation under study.

4.2 Saudi Arabian Healthcare System

This research focuses on the Kingdom of Saudi Arabia context. With a population of 26 million residents and an annual growth rate of 2.2%, the healthcare sector in Saudi Arabia needs to service a growing population alongside an increased demand for healthcare. The Saudi Arabian Ministry of Health (MoH) is the main government agency entrusted with the provision of preventive, curative and rehabilitative medical services. MoH public hospitals provide healthcare services at primary, secondary and tertiary levels to all citizens free of charge (Suginaka *et al.*, 2014). As shown in Figure 3, approximately 60% of all hospitals in Saudi Arabia are public hospitals, which fall under the jurisdiction of the MoH. The remaining health care providers consist of the private sector, university hospitals, and other government departments such as the Ministry of Defence and Aviation (Hasanain *et al.*, 2014a).

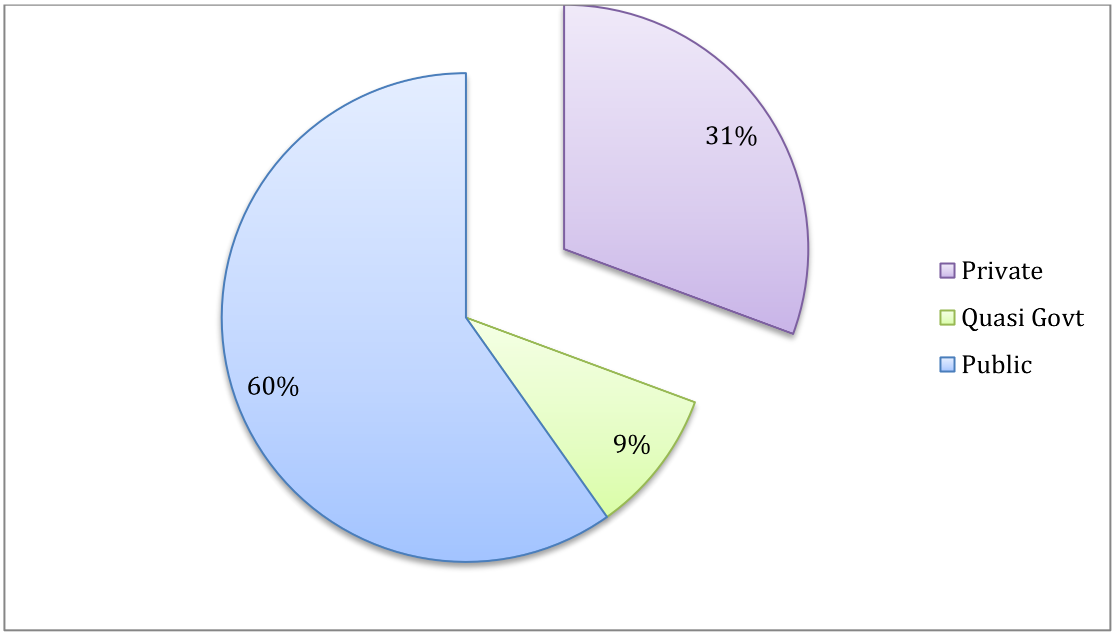


Figure 4-2: The number of healthcare organisations in Saudi Arabia as per. The Ministry of Health (MoH, 2014, p.86).

In the early 1950s, health services in Saudi Arabia had fewer than 100 hospital beds. However, at present, the Ministry of Health has a total government budget of more than SR. 160 billion (Hasanain *et al.*, 2014a). There are 387 hospitals in total, some of which are advanced medicinal healthcare organisations that provide a variety of sophisticated treatments such as open-heart surgery, kidney transplants, and cancer therapies. The total number of beds in all hospitals is 53,519, with 31,420 of these existing in MoH hospitals; this corresponds to 58.7% of the total number of beds in the Kingdom. There are 2.2 beds per 1,000 people, equating to one bed for every 453 people. The total number of physicians in the Kingdom (including dentists) is 47,919; 21.6% of these are Saudi. The total number of dentists is 6,049 (excluding those that work in private clinics). 21.1% of these (1,275) are Saudi-born. The total number of pharmacists is 15,043 (excluding those working in the private sector); 1,875 pharmacists (12.5%) are Saudi, while 99% of the pharmacists working in private pharmacies are non-Saudi. The total number of nurses is 93,735; 28.8% of these are Saudi, while allied health personnel totals 51,288, with 59.1% being of Saudi nationality (MOH, 2010).

4.2.1 Health Information Technology (HIT) in Saudi Arabia

Technology has become an essential strategic management asset for the private and public sectors in Saudi Arabia. As technology, can provide distinctive advantages, it may contribute significantly to the success of a firm. As such, technology may provide a competitive advantage for private hospitals. Therefore, managing technology effectively has become crucial in today's competitive environment. ICT plays a significant role in all contemporary economies. Saudi Arabia's information and communications technology (ICT) market is one of the largest in the Middle East. The Ministry of Communication and Information Technology was formed in 2003, and the Saudi National Plan for ICT was announced in 2005, with the express purpose of controlling, regulating and developing ICT services and plans in Saudi Arabia.

There is growing concern about the underutilization of EHRs in Saudi. However, adopting health information technology has already begun in a number of public hospitals, such as in King Fahad in Madinah. Using technology in healthcare in Saudi Arabia is based on EHRs/EMRs practices, and it is the main technology (Alkhamis, 2017). On the other hand, mHealth is not implemented in all of the public hospitals because of the cost. EHRs/EMRs systems are not linked to other public or private hospitals. Furthermore, to improve the adopting technology in health care, the government of Saudi represented by the Ministry of Health runs four year IT development programmes, with budgets of US$ 1.1 billion (Qurban and Austria, 2008).

In addition, most of the coordination among health care providers is needed to improve the use of HIT strategies and launch a comprehensive national system for health information (Altuwaijri, 2008). A high level of coordination must be achieved with other related sectors to provide the required infrastructure such as Internet and phone services. There are a number of challenges that the MoH in Saudi Arabia is dealing with, such as vast geography, large growth, and diseases. MoH began to adopt technology in healthcare such as e-health concept by consented on Saudi Arabia patients centric care (Almalki *et al.*, 2011). This is by building a significant nationwide EHRs networking that allows more than 3,500 healthcare organisations to share patient's health record data.

4.2.2 Al-Madinah Al-Munawarah Region

Al-Madinah Al-Munawarah is the holy city to Muslims after Makkah. There are many other names such as Tabah, Taibah, Yathrib, and Dar Al-Hijra. It is the city where Prophet Mohammad "Peace is upon him" moved out from Makkah. Madinah (Al Madina Al-Munawara), is the city of the Prophet Muhammad and his burial place. It was the first Islamic City was located on the country's west side, along with the Red Sea coast. It has an area of 151,990 km² and a population of 1,777,973.

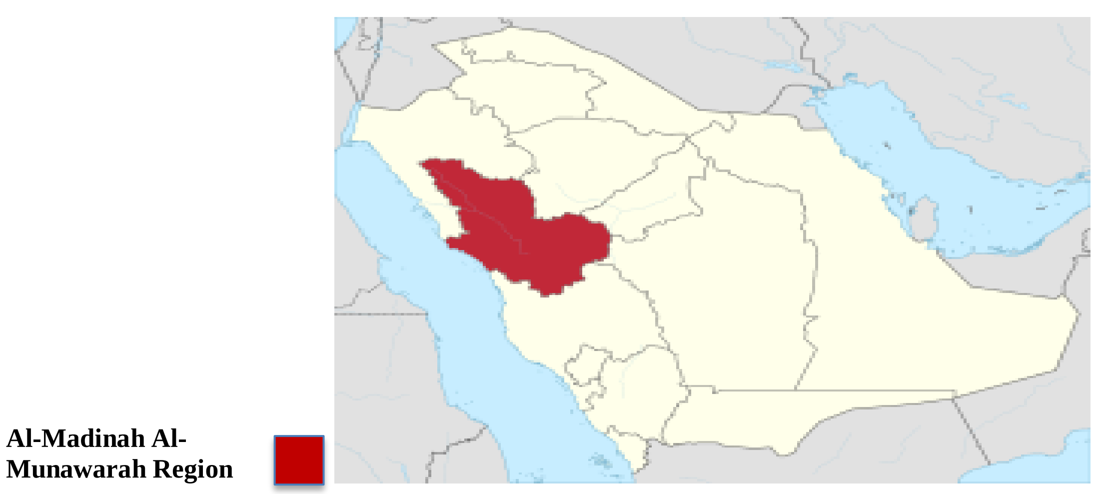


Figure 4-3: Madinah Region

The Ministry of Health (MOH), as represented by the Health Affairs General Directorate of Madinah Region, has carried out all preparations for providing health services. The Ministry has prepared an integrated health plan, aiming to attain the best possible level of performance for health services for both citizens and residents. Thus, the Ministry seeks to provide a host of integrated health services, using curative, preventive, and ambulatory programs, through highly equipped health facilities, and well-qualified calibres, which are trained in providing such services.

The Madinah Health Affairs General Directorate has managed to prepare nine hospitals, with a total bed capacity of over 1,300 beds, in addition to 139 IC and emergency beds, with the aim of providing health services. These hospitals are: King Fahad hospitals (423 beds), al-Ansar Hospital (100 beds), al-Miqat Hospital (65 beds), Ohud Hospital (261 beds), al-Hanakiyah Hospital (50 beds), Khaibar Hospital (50 beds), AL-Hemnah Hospital (50 beds), Yanbo' Hospital (279 beds), and Wadi al-Fara' (50 beds). Meanwhile, the remaining governmental hospitals in Madinah region are considered as the third frontline, to address potential disasters. Madinah's private-sector hospitals are regarded as the fourth front line in cases of disasters, or the inadequacy of MOH hospitals' beds. These hospitals are further supported by 15 primary health care centres spread all over the central area, around the sacred precincts of Madinah, the places where pilgrims gather, as well as the main roads leading to the Hajj Sites. Four health centres have been prepared in the patients surrounding the Madinah Sanctuary.

At the points of entry to Madinah, three health control centers have been established; they are: the health control center annexed to Prince Mohamed bin Abdulaziz Airport (Madinah), the health control center annexed to Prince Abdulmohsin bin Abdulaziz Airport (Yanbo'), and the health control center at Yanbu' Commercial Port. That is to be added to the clinic of the guests of the Custodian of the Two Holy Mosques, currently being established at one of the hotels assigned to host pilgrims. These centres accommodate 55 beds, and this number can be increased to 61 beds when having al-Safiyah Center expanded.

Recently, it is worth mentioning, al-Miqat 2 Health Center has been established, and Bab al-Salam Health Center has been renovated. Right now, a health centre is being constructed on Riyadh Road, whereas Bab al-Majidi Health Center and al-Hijrah Station Health Center are being renovated, in addition to expanding al-Safiyah Health Center.

The Madinah Health Affairs General Directorate has shown a keen interest in preparing those health facilities and supplying them with ambulances, in coordination with the Saudi Red Crescent Authority, through the Emergency and Crisis Management Department, with the purpose of moving cases referred from health centres to hospitals. Besides, the necessary medical equipment, drugs, tools, and vaccines, as well as the equipment required for health awareness (monitors, signs, posters, and brochures), have all been adequately provided. The labour force existing at such facilities has been determined, to identify the required medical cadres, and train them in providing health services for pilgrims. The Ministry has also supplied the Madinah Region with small and big ambulances to carry out the emergency and crises plan before and after the Hajj season, and to quickly intervene to handle cases and take them to health facilities. In addition, laboratory requirements have been supplied in adequate quantities and conveniently stored; this is to be added to the supply of adequate quantities of blood and blood products to the Central Blood bank and peripheral blood banks.

4.3 Case Study One: Ohud Hospital

4.3.1 Background

Ohud Hospital is a public hospital with a 261-bed in the outskirts of Madinah Al Munawara, Saudi Arabia. The hospital also contains a residential campus where the hospital doctors and nurses reside. In 1980, it started its life as a charity hospital called Badr Al-Khairi, and because it was well constructed and neat, it was taken over by the MOH. The same campus is also located on the outskirts of Mecca. Emergency and traffic accidents cases in Madinah and areas around are referred to it since the clinical capacity reaches 1500 patients per 24 hours.

Ohud hospital has implemented the "Open Architecture Specialized Information System “HMIS” Hospital Management Information System" (OASIS) as their core EMRs. They used “Balsam United” as a vendor of the hospital management information system. Balsam United is a leading provider of healthcare solutions in Saudi Arabia.

At the same time, the system is modular in design, with modules addressing specific functional requirements. Balsam did implement individual modules such as “Medical File Recording” of OASIS on a stand-alone basis and integrate with other modules, and it can come online, all OASIS modules are incorporated into a cohesive and robust system.

The main challenge of adopting the system is that users dealing with technology. According to IT staff, who reported that the main difficulty is the clinical staff who are dealing with the system. IT staff has well trained the clinic staff monthly. However, most of them are old ages users, and they have been using the paperwork for a long term. Also, the most IT challenge is based on computer networks that link between users in the hospital. There is a high load on the system, and there is a high user demand too. On the other hand, several benefits found regarding of using OASIS. IT staff mentioned that using OASIS brings realistic and accreting statistics. Further, using the OASIS able to secure the data and never losing by every week backup. It is important to mention that there was no specific model that to adopt OASIS. Following point views are analysing the findings under three themes, which will be presented.

4.3.2 The interview results

4.3.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs

4.3.2.1.1 Technical factors

Many interviewees expressed that the system was well linked with all departments in the hospital, which improved services, as well as saving time for patients:

> *"…The system is linked to the pharmacy as well as radiology department. Which help and save time for patient and clinic staff in OPD". (19-20, P5/OH Clinical staff).*

In some cases, there were technical issues reported by clinical staff based on running the system. For instance, it was hard to fully adopted, as some staff still used paperwork in some tasks, e.g. the radiology department. Additionally, interviewees reported that there were technical issues with the availability of medicine on the system, so the users had to write the prescriptions by hand.

> *"For most of the order we use the system, but sometimes we use paper for x-ray orders in small cases. I think the most medicines are available in the system, but some of the medicines are not on the list, so we use paper for that. However, we try to add manually, we contact IT to add them, and we are waiting for since then." (22-26, P5/OH. Clinical staff).*

> *"There is no more load for us to use paper and system at the same time it very organises. We do not face any problem or difficulty. I think the only problem is the system does not give us all medicine that we want." (30-32, P5/OH Clinical staff).*

> *"The main issue of the program is developing some area such as the prescription area. For example, using quantity in the prescription section but sometimes does not show. The system is not entirely completed there is some error, so we use the phone to contact them." (43-46, P5/OH Clinical staff).*

The majority of interviewees agreed that the system was good and organised, with no need to use paper anymore. However, participant 4 noted the system was too complex and complicated, so there was a need to use paper:

> *"I think the system is overall good but the information that in the system is more widely complicated and not narrow. There is some information that not enough in the system so we need to have the paper file." (24-25, P4/OH. Administration staff).*

Additionally, interviewees pointed out a technical issue, which the system shuts down from time to time. Thus, there was no trust in using the system. There was worry that the shutdown of the system would be a high risk, especially during surgery:

> *"I think very difficult to trust the system because the system is shut down sometimes, which affects our work from time to time. However, I think using the system is more fun and handy." (65-67, P5/OH. Clinical staff).*

Because of using the system, writing prescription by handwriting was very difficult to read between clinical staff. Thus, participant 5 found that typing prescription as well as diagnostic by using OASIS better than handwriting which makes clear to read. This can be a technical factor, which enhances using the system to solve such as handwriting issues. The following quotation has clarified the point.

> *"First thing, I think using paper is difficult to read handwriting for some of the clinical staff. However, I believe that it would be easy and definite in the system. "(74-75, P5/OH. Clinical staff).*

The majority of interviewees viewed that the main technical factor to be the hospital infrastructure. There was an agreement related to the low quality of IT infrastructure. Participant 4 said:

> *"I think so far we do have enough infrastructure, but we have some old PCs in some departments effect to use the system" (36-37, P4/OH. Administration staff).*

According to participants 1 and 2, the Ohud hospital is an ancient hospital, with a less organised networking system. There were shutdowns from time to time, as well as high demand users. Thus, users had less trust in using the system, which made implementing any update of the system complicated. The IT specialist found that it was hard to adopt the system because of the inadequate infrastructure. Others expressed similar views:

> *"I think the most risk that we have in the past is the system is a breakdown, the loose of information is happen only once (96-70, P4/OH. Administration staff).*

> *"The for infrastructure Ohud hospital is very unorganised because of the building very old. The main challenge is the networking we found very difficult to adopt any technology. All networking links are external network extenders. The vendors are not able to work professionally because the building is too old." (24-27, P2/OH. IT specialist).*

> *"The system sometimes shut down for 10 min, so the at affect us for the trust of users to use technology." (63-64, P2/OH. IT specialist).*

> *"In general, we have a good infrastructure such as new servers and networking there is only one server that we have the problem which shut down once for 2 years, the infrastructure of the Ohud hospital is very old, but we have updated that building which able us to implement the system we still use the paperwork as the system that we have not fully implemented the main issues is the users who not able to accept the system. So, they still use the papers work." (22-26, P1/OH. Head of the E-health).*

> *"The main risk that is a load of users with less network system that we have. We try to add more switches, but the hospital is very old." (64-65, P1/OH. Head of the E-health).*

4.3.2.1.2 Social factors

The interviews aimed to develop a deeper understanding of social factors that influence the adoption of the OASIS system in Ohud hospital. Many interviewees expressed essential social factors related to training. However, some interviewees did not express training as an essential social factor because they found the system easy to use but noted overload and the need to use paper files from time to time. For example, participant 5 preferred using paper more:

> *"I think using the system is not simple to much need to focus on the screen, but I think using handwriting is better" (35-36, P5/OH).*

The majority of interviewees agreed that there was enough support for implementing OASIS. As mentioned below, there were workshops from time to time to educate users about how to use the system.

> *"We do have workshops from time to time to develop our skills of using the system." (39-40, P5/OH).*

> *"I think IT needs more support to help us to implement the technology. However, I agree they are doing agreed work to support us and implementing the Oasis. (63-64, P4/OH. Administration staff).*

> *"We always have support from IT how always give us orientation and support." (61, P5/OH).*

> *"The training and education for the clinical staff took about one month able us to teach and fix the challenges; we started the system for two weeks after training after that we implement the system." (19-20, P1/OH. Head of the E-health).*

Regarding the training factor, interviewee mentioned a critical point, which develops IT staff's skills that able them to make the training and workshops for users during adopt the OASIS system. Thus, they had to communicate with vendor always for supporting. Following quotations explain the point clearly:

> *"The OASIS system is the core health care system has been used internationally. According to the head of the hospital some of the model that we use, some other model that we do not need to use. The reason behind that, I think the IT staff has less experience, training, and employees." (25-28, P3/OH. IT specialist).*

> *"The training for us as developers is not well. We have not been in training lessons, which make it difficult for us to support the users. All we are doing is being diligence. We also contact with main vendor "Balsam" who able to support us if there any issues." (15-18, P2/OH. IT specialist).*

Another interviewee offered an interesting point explaining the motivation for using OASIS. As a result, the system reduced the enormous number of patient paper files, which also reduced the space needed for them. This can improve accessibility for users, which enabled them to follow up and improve patient care. This was the main reason for adopting the system. As one of the managers said:

> *"In my opinion, the main motivation to use system is to reduce the space that we have from old file paper as well as take too much time to find the file. We do have more than 200000 files active, which take the long process to find." (49-51, P4/OH. Administration staff).*

The interviewees pointed out that some users only use paper patient's files. So, the system could be useless because some patient records were not updated and added to the system.

> *"I think the main issues we do have is the users; the users do not fill all the gap I the system such as diagnostic" (54-55, P4/OH. Administration staff).*

> *"Some issues regarding users are attitude some of the users do not accept the technology, so the looking for any problem in the system to stop using it. Some users are happy with the system and behaviour well and using the systems in a professional way" (27-30, P1/OH. Head of the E-health).*

Some interesting data concerning the implementation of OASIS was the age of users. Interviewees expressed that there was older clinical staff who were not familiar with using technology, especially OASIS. Thus, they preferred paper files more than electronic files. In addition, it affected their time, especially when duplicated adding health data in both electronic and paper file.

> *"We have the problem with the old age consultant who is not adjusting it to the system. They take a long time with patients which writing the prescription both electronic and paper file." (34-35, P1/OH. Head of the E-health).*

In addition, the main social factor was cultural, as the primary challenge to adapt and accept technology. Younger users can use technology better than old users:

> *"The behaviour of using technology is about the culture that accepts technology and users who will able to adjust technology." (68-69, P1/OH. Head of the E-health)*

> *"Also, the old users such as old consulted from clinical staff who not educated to use technology, will not accept OASIS." (70-71, P1/OH. Head of the E-health)*

> *"I think most of the users take time for typing adding data which take time for doctors to finish the patients "over loud" so most of the clinical staff are not interested in the technology especially OASIS because it is over loud to them. However, some of the users adding the less and uncompleted data, which make the system useless sometimes" (45-50, P3/OH. IT specialist).*

> *"I think everyone here helps us to use and implementing Oasis but there are some users make it difficult for us. There is some problem with security which not able us to fully implementing the system as well as much the plan. We try to make the system is used out of the hospital by staff but According to policy standard and security will not able to do it." (83-87, P3/OH. IT specialist).*

4.3.2.1.3 Organizational and administrative factors

Organizational and administrative factors are wildly mentioned during interviewees, but some of the interviewees mentioned an important point, which will be illustrated. First of all, the majority of interviewees agreed that OASIS is saving time and fast for users which able to make the decision easy and fast.

> *"… I think every organisation has to have a list of evaluation, by using the system will help top management to see and manage the performance. The statistics report, for example, it will be a minute to support making the decision fast and easy" (93-95, P4/OH. Administration staff).*

The top management in the Ohud hospital was understanding how much essential to use the system at all management levels. The main objective is to be less paper use which saving time for the users. According to participant 4 and 5, the top management enhances them to use the technology because of reducing the time and being paperless.

> *"Yes, of course, there is guidance from top management to enhance us to use the technology." (16-17, P4/OH. Administration staff).*

> *"It is also easy to search for old data by electronic file than paper. It is quick, easy and handy. It saves time for us." (76-77. P5/OH. Clinical staff).*

There was expressed that the idea of using a system should link by the different health organisations. Interviewee below strongly statements, and highly recommended to allow the system to access and sharing the data for both outpatients and other hospitals. The purpose of that is to save and improve health care quality for both doctors and patients especially in the emergency cases. As one of the participants said:

> *"It is a good idea it will make transfer patients between hospitals very fast. We need it; I think it will able to improve the safety as well as the service for the patient especially in*

emergency cases. I think it will make the life easy for both doctors and patients" (89-92. P5/OH. Clinical staff).

"I think, there is no problem with financial or technology the problem is the staffs "user" we have to c the users to accept the technology the users do not want to use the technology. However, the young generation is accepting the technology and happy to use it." (68-71, P3/OH. IT specialist).

Additionally, the organizational and administrative factors including privacy and policy have mentioned in interviews. Based on the hospital strategy there was taken into consideration both confidentiality and policy during adoption OASIS. Another interviewee considered policy and financial resources as the main challenge to adopt OASIS below quotations are explained.

"We do have strategic that based on privacy and policy. The head of the hospital targeting to be less paper." (40-42, P4/OH. Administration staff).

"The policy and financial are challenging during implementing EMRs, changing the policy in public sector is take too long." (59-60, P4/OH. Administration staff).

However, participant 3 did not agree with participant 4 about financial as a factor. His idea was, there was no problem of the budget as the financial resources are enough. It is interesting that the majority of interviewed strongly agreed that the main factor is making OASIS influence to adapt is be accepting of users. As one of the IT specialists said:

"There was no problem with financial or technology the problem is the staffs "user" we have to encourage the users to accept the technology as the most users do not want to use the technology. However, the young generation is accepting the technology and them happy to use it." (68-71, P3/OH. IT specialist).

The process of managers implementing the system is very complex and takes a long time, which makes it hard for decision makers. There was limited support for the implementing OASIS. As a result, users and IT staff were not optimistic with the management strategy that had been made by the ministry of health:

> *"There is some extra option in OASIS system that needs to update it. However, it takes a long time to approve from top management and sometimes needs to contact with Ministry of health to get approval. (65-66, P4/OH. Administration staff).*

Participant 1, considered the challenge of having less number of the employees working in IT department as the main factor that challenges to influence adoption technology. Having limited employees can be considered as organisational and administrative factors, which affect implementing the system. The quotation from the head of the E-health reported:

> *"We have a low number of employees in the E-health department, and that can challenge to adopt the technology" (32 P1/OH. Head of the E-health).*

Furthermore, the head of e-health highlighted the main purpose of using OASIS from a management point view. He agreed that the plan was to reduce using paper, which can be changing in the future to be all patient file electronic. The ministry of health encourages the use of the system especially for ordering medicine online. Moreover, it links all data electronically, which making statistic report as well as financial report available, easy and fast. Thus, he stated that using OASIS could help top management in the ministry of health control the budget more easily. For example, if the pharmacy staff gives a patient prescription by using the system one-medication bar, there will be no extra medicine and no interference medication because of the system able to reduce those risks. However, using paper prescriptions will be hard to follow stock as well as lessen the risk of interference medication.

> *"I think the hospital will use less paper file in future. For the ministry of health here in Saudi Arabia point of view, the plan is using the system especially for ordering medicine by online and linking all patient data electronic this is will improve control cost and demand. It will help Ministry of health to control the budget easily. For example, if the hospital gives you online one medication bar by the system will not able the pharmacy gives you any later without E-prescription. However, by using paper will be hard to follow up stock as well as managing to order the medicine. Using the system EMRs is better than the paper file because it will able to save time as well as reduce the risk of damaging the file. I think using the system will able us to have accurate statistics fast and efficient." (45-53, P1/OH. Head of the E-health).*

Lastly, there was difficulty in adopting OASIS in the emergency department, as the system could not serve the patients fast enough. The emergency department was very different from other clinical departments. As the results show, there are a high number of patients, 1500 patients, every 24 hours in the emergency department. Thus, the doctors in the emergency department need to spend more time with patient's treatment than spending time adding data to the system. The emergency department also differed significantly in how they managed time. The participants stated that the system was not suited to the emergency department, where time is valuable, in saving patients' lives.

> *"We notice too many patients in Emergency, so using OASIS technology in the emergency would be a risk because it will make the procedure of serving patient taking long. In emergency clinic staffs are using handwriting rather than using the system." (53-55, P3/OH. IT specialist).*

4.3.2.2 Theme two: the impacts of HIT-related EMRs on health care

Interviewees' perception of impact can be divided into several broad views. Interviewees believed there was a higher positive impact on saving time for both patients as well as clinical staff. These interviewees believed using OASIS could make finding health records easy and fast, as using paper files can be difficult and needs more time in some cases. Clinical staff stated:

> *"... by using OASIS, I think it has a positive impact especially for saving time; it is also making information very easy to find. I found my self-searching for patients by paper take too long to find health record." (39-40, P5/OH Clinical staff).*

> *"I think using OASIS has a positive impact on patients. I think finding the patient's details as well as saving the patient data is more effective and efficient. Also, I think using OASIS is helpful for statistic point view. (22-25, P1/OH. Head of the E-health).*

Additionally, interviewees noted that there was a positive impact on following up health patient's history by using OASIS. This enabled clinical staff to improve the safety of the patients. Participant 5 approved of the system.

> *"I think the system helps us to follow up the patients' health history in case the information loses it; the system is elementary and handy." (70-71. P5/OH. Clinical staff).*

On the other hand, there was a negative impact on using the system, which reported by participant 5. The system sometimes shut down from time to time which makes the health services by the system slow. Furthermore, interviewees noted that there is no impact on the privacy of using OASIS, as the data is well secure. As mentioned below, every clinical staff has their passwords and ID to access the system.

> *"The disadvantage is when writing the quantity of medicine* and *sometimes notice that the system shut down. So, we should wait until the system work. (79-81. P5/OH. Clinical staff).*

> *"I do not think there is a disadvantage and in my opinion, it has more advantage than the disadvantage, and there will be no impacts on privacy." (96-97. P5/OH. Clinical staff).*

> *"I think has no impact on privacy in some cases and I do accept to share the data outside of the hospital electronically." (92-93. P2/OH. IT specialist)*

However, participant 4 disagreed with participants 5 and 2 related to privacy. He stated that using paper files are more secure than using the system. He believed that using paper files would reduce the number of access, so there is no access to any points in the hospital as OASIS does. Another reason for making using paper file is secured, the medical staff is not allowed to modify and change patient data by using the paper file. Thus, it can be reduced the health professionals' mistakes. List of participant 4 statements presented as below.

> *"The privacy of the data by using traditional ways, I mean the paper file is more secure than electronic. There are several reasons behind that; the main reason is to reduce the number to access the file. By using the system also, it will able to access the file anywhere in the hospital, so the information is not secure" (74-77, P4/OH. Administration staff).*

> *"The users in the system able to change and adding data any time which makes the less secure and privacy." (79-80, P4/OH. Administration staff).*

> *"Using paper will reduce the doctor's mistakes or fix any health data with more safety and legal for the patients. Also, the system can help to follow the patients easy." (82-83, P4/OH. Administration staff).*

Many interviewees assumed that using the system would have a positive impact on different areas, in controlling disease and making statistical report fast, which can reduce the time and cost in protecting people. From an administration point of view, there was better decision-making when using OASIS, which included better planning for human resources, as well as in relation to purchases medicines.

> *"Using HIT is highly a positive and I recommended to implementing to develop our culture, it will help us to catalogue the disease and make statistics report fast and easy. Using system will control the cost of the hospital quick and easy. It will also be able to make the easy decision in the future. Also, using the system will easy to help to plan the need for human resource in the future. I think by using the system will help us to control the needs of the medicine and how much we need in the future." (91-96, P4/OH. Administration staff).*

> *"I think that will help to reduce the risk of medical mistakes, makes statistic number easy and fast to collect so the top management make their decision in real time, in the private hospitals, unfortunately, are looking to collect money rather than services the patients. So, if there one files the doctors will not ask the patient more money such as more cost in ordering lab or radiology test. If the system linked with other private and public, it would help to reduce cost, time …etc." (100-106, P4/OH. Administration staff).*

> *"The main impact I think is the demand of patients, especially on eye clinic." (70, P2/OH. IT specialist).*

> *"Making statistical report is easy to get via the system to help external side to make the decision such as the ministry of health." (104-105, P3/OH. IT specialist).*

There was a negative impact of using the system as participant 2 believed. This interviewee made an interesting comment regarding using OASIS which cannot able the health professionals to serve more patients by using the system. Interviewees offered several reasons for this view.

The main reason is health professionals' needs more time for adding and typing in the system which is easy if users could use the paper file as mentioned below.

> *"Using the technology has the negative impact, which cannot able clinical staff serves more patients because of they need more time for adding in the system." (88-89, P2/OH. IT specialist).*

Most interviewees strongly agreed that the main reason for using the system was to eliminate the use of paper files. Participant 1 reported that the vision of the MOH was to implement health record systems for all public hospitals. The head of E-health presented a list of the impacts of health record systems on Saudi healthcare. Firstly, the system will reduce time and cost, both internally and externally. This will control demand and follow up the medical supplies. Secondly, he expressed the impact of using OASIS based on comparisons between paper files electronic file, which has high impacts on the paper file and damaging by regular use. As one of the managers noted:

> *"The way what the hospitals use by paper will be changing by the time to be less paper use. For the ministry of health here in Saudi Arabia point of view, using the system especially for ordering medicine by online and linking all data such as cost and demand, it will help Ministry of health to control the budget easily. For example, if the hospital gives you online one medication bar by the system will not able the pharmacy gives you any later without E-prescription from the doctor. However, by using paper will be hard to follow stock as well as managing above ordering the medicine tapes. Using the system EMRs is better than the paper file because it will able to save time as well as reduce the risk of damaging the file. Using system will able us to have accurate statistics fast and efficient." (45-53, P1/OH. Head of E-health)*

> *"Using the system will be able to reduce using paper which the target of being less paper. The OASIS has high privacy, which allows the doctors only to get access to add details to the patient file." (41-44, P3/OH. IT specialist).*

The majority of interviewees viewed OASIS as having a positive impact on the healthcare sector. Theses interviewees made comments such as "it is a positive influence more than negative". The interviewees offered some reasons for this view. Firstly, many interviewees agreed that using OASIS would secure the health data and improve health care. As the following quotation is included as:

> *"Of course, we do have impacts, if the system 100% implement we can see positive impact more than negative. Nowadays, we should buck up the huge number of file paper in the system. This will reduce using paper, and we do not lose the patient file anymore" (90-92, P3/OH. IT specialist).*

4.3.2.3 Theme three: the model of adoption EMRs

There were no clear steps to implement technology, which was the main difficulty during implementation. Many interviewees agreed that there were no apparent steps to implementing OASIS. Participant 4 reported that there is a need for top management to clarify the steps to apply the technology. The quotation presented below.

> *"I think it takes a long time to implement and IT staff has not clear steps to how to implement IT." (84-85. P5/OH. Clinical staff).*

> *"There were no steps, but we do some meeting with top management to make the clearance process to implement the technology." (20-21, P4/OH. Administration staff).*

However, a few participants disagreed with that view. They mentioned several steps for how to implement OASIS. Firstly, the IT staff starts by explaining the system to the users before starting to train them, which can take a few weeks. Secondly, IT staff can improve the system with the vendor and fix the feedback from users. Lastly, both the IT department and the vendor can start to implement the system. Typically, the process of implementing the system takes a few months. The interviewees highlighted that there was excellent support from the vendor.

“The first step we have is distribution folded paper to explain the user about the system. Then we train all the clinical staff on how to use the system. The clinical staff can see his/her schedule for training. To improve the system, there is some feedback that comes from users such as choice medicines by brand name or scientific name. We are an IT department tries to make the systems suit to the users. The vendor has always supported us.” (42-46, P2/OH. IT specialist).

“First, we have the model for every function, for example, we have to implement the system on the OPD which start first with the prescription order model. We start with the users who work in the OPD and explain to them the process, and how to use that then we implement the system.” (16-18, P1/OH. Head of the E-health)

“Yes, we have. In general, we start by establishing the system then checking lastly training the users.” (55, P1/OH. Head of the E-health)

“There is no specific model or procedure, the main step is the developer set up with the user and develops the steps that he/she needs to implement IT. The developer can develop the system by changing models step by step with contacting the vendor. Normally after implementing the model, the developer installs the OASIS on the PCs and teach as well as training the users.” (34-38, P3/OH. IT specialist).

4.4 Case Study Two: King Fahad Hospital

4.4.1 Background

King Fahd Hospital is a public governmental hospital in Madinah Munawarah in Saudi Arabia, built in 1980. It is one of five hospitals of the same name, constructed in the era of King Fahad Bin Abdulaziz, in different regions in the kingdom. It is considered a medical landmark, as it is the most significant comprehensive contemporary healthcare provider for the Ministry of Health in the Madinah region. Emergency and traffic accidents cases in Madinah and areas around are referred to it since its clinical capacity reaches 500 beds. King Fahd Hospital includes several clinics such as specialised dental centre, diabetes care centre, telehealth centre, and a kidney diseases centre.

The core health information technology adopted at King Fahad hospital is called "Medical-plus". Clinical staff must have a user ID and password, which allows them to report, diagnose and see laboratory results. Patients have their file number, which is linked to a public identification number. The IT department has cooperated with the Gulf Company "vendor" to implement the system. The Medical-plus system was adopted within five years with a high number of challenges and issues that will be discussed. The researcher interviewed five members, from a cohort of both clinical staff and administration staff. The interviews lasted on average about 30 minutes.

Overall results show that there was no specific model to adopt the systems. However, both clinical and IT department have limited knowledge to adopt the technology. The researcher found that the users preferred to use paper rather than using the system.

The main reason behind this is that older consultant users have less knowledge about how to use the system and in dealing with technology. Users have mentioned that using paperwork can reduce the time of waiting lists in OPD. There is no doubt that technology such as the Medical-plus system has positive impacts on healthcare than using paperwork files which will be analysed.

4.4.2 The interview results

4.4.2.1 *Theme one: the critical factors influencing the adoption of HIT-related EMRs*

4.4.2.1.1 Technical factors

When discussing technical factors, some interviewees expressed different technical factors concerning hospital infrastructure, accessibility to use the system, and system interfaces. Firstly, interviewees discussed technological factors such as fragile hospital infrastructure, which included old PCs, less networking, and servers. In fact, there was an agreement between all interviewees about how the infrastructure design hindered supporting new technology.

> *"The infrastructure is terrible, starting with having bad the data centre. As you know the hospital is a very old. PCs that we have are very old too. There is a limitation of the number PCs about 500 PCs and that are not cover all users" (61-63, P1/KFH. Head of IT).*

> *"The networking that we have in the hospital is very old. Also, the PCs that we have is ancient too." (32-33, P3/KFH. IT specialist).*

> *"The main reason for using the paper as the system is shut down regularly." (27, P4/KFH. Health professional).*

> *"The problem is the PCs that we use in the hospital are old some they are more than eight years old. I think the PCs should change every three years." (38-40, P5/KFH. IT specialist).*

> *"There is using both paper file and the system. However, we are trying to be entirely systematic. There is enough IT infrastructure there are no issues with that." (40-41, P3/KFH. IT specialist).*

> *"I think the infrastructure of IT in our hospital is very weak, which making implementing the system challenging." (46-47, P5/KFH. IT specialist).*

Furthermore, many interviewees expressed a high default in the infrastructure, which made the users less likely to trust the system. Interviewees stated that they had to wait longer to open the system, which delayed patients during an examination at the OPD. Additionally, all interviewees agreed that the PCs were old, making the system useless and very slow. However, the interviewees did mention there is regularly scheduled maintenance for all PCs.

> *"There is scheduled maintenance in our IT department to make sure all PCs in the hospital work well. We change the PCs every three years." (65-66, P1/KFH. Head of IT).*

In addition, there were different views relating to using the systems and facing technical issues during operation. Take for example the following quotations as examples:

> *"There is one of the most problems is the system which is very slow during the examination, especially at OPD. There is more than 500 patients process daily, which means we have high load and slowing the system will affect us. I think the problem based on the servers in OPD; it should be based on web connections." (84-87, P1/KFH. Head of IT).*

> *"I have to mention that, there are no issues of using the system in the surgery department. Only the old PCs that we have in the OPD make the work slow and the system useless." (11-12, P2/KFH. Health professional).*

Accessibility of health data was a concern for most of the interviewees. For many respondents, this lack of accessibility led to concerns about using the system, as they needed to access the system anywhere and anytime to get patients' data during treatment. This factor can be a disadvantage for using the system, especially with the difficulty of old infrastructure in the hospital. As can be seen from the interviewees, the advantage of the system is to be accessible for health professionals especially out of the hospital and that was not offered by the current system that mentioned in following quotations.

> *"There is one disadvantage, I think there is less accessible for us especially out of the hospital. I believe that there is an update of using the system, but it is likely not to be supposed. The system is not linked well with receptions electronically. There is still using paper for queuing; there is working based on a paper in the emergency department as well, which needs to be improved." (10-13, P4/KFH. Health professional).*

The interviewees explored the reason behind why there are fewer access points which is a significant factor challenge to adopt the "Medical-plus." The reason behind that there are no enough PCs support using the system. There were two broad views of fewer accessibility issues were discussed by interviewees. Firstly, many interviewees believed that they need to access the system anywhere internally and externally of the hospital. However, this view disagreed with IT regulation makers in the hospital. Because they believe that, both policy and privacy is main priority that concern by top managers that control accessibility while adopting the system. Secondly, some interviewees indicated accessibility factor, as the access to the system run slowly and loading for a long time that makes the health services take long. The views are illustrated in the quotes below.

> *"I think "Medical-plus" is a good system, but there is not enough equipment including PCs that can do our work as nursing comfort ability integrated with other. One of the issues*

we have is slow networks systems, and I think this is the reason the system very slow." (7-9, P4/KFH. Health professional).

"I think access is difficult as well as the PCs are very old. There is a shutdown of the system from time to time that makes using the system, not trustable. That why we use paper and other technology to communicate for example WhatsApp...etc." (29-31, P2/KFH. Health professional).

"I would like to mention that there are not enough access points in the hospital and fewer maintenance staffs." (50-51, P2/KFH. Health professional).

Some interviewees expressed that the system interfaces as a technical factor that challenges to use the system in the hospitals. Some of the functions of the system are very complicated which need to improve. The small number of interviews, they had the difficulty of using the current interface of the system. This is one of the reasons why some users use paper rather than the system. As a result, some interviewees expressed negative attitudes when dealing with the system.

"*There are many issues of using medical plus. However, I would like to highlight main issues, there are too many sections in the system we have to fill in, and that makes us unable to see all OPD patients on time. I found that if we use paper file only rather than the system, it will help us to serve more than 15 patients in the day but with the system we only able to serve ten patients." (33-36, P2/KFH. Health professional).*

"The system of Medical Plus has a high IT resources such as advance PCs which we do not have. There are many complaints from users about the system is very slow." (42-43, P5/KFH. IT specialist).

4.4.2.1.2 Social factors

Another factor, which was evident throughout the interviews, was Social factors. These are described as experiences that influence users' personality, lifestyles, and attitudes. These were categorised into several sub-factors, which were training and educational levels, trust, attitudes, cultural, and age. Many interviewees found that training and education levels were the main factors that influence them to accept using the Medical-Plus system. Interviewees reported that the training was not enough to use the system correctly. The interviewees also discussed educational level as an essential factor to use the system. Participant 2 stated that the level of education for users was not enough during and after implementing the system

> *"The main problem here the users who have not encouraged themselves to use the system. There was not enough training as well as there is no encourage from top management to use technology" (8-10, P2/KFH. Health professional).*

> *"I think there is not enough education for how to use the system, especially in health educational organisations such university" (74-75, P2/KFH. Health professional).*

Many interviewees expressed low default trust and attitude in health professionals. Interviewees stated that they had a bad experience before with using the system in the past, which makes using the system not trustable. As interviewees expressed a low confidence, users were frustrated with using the system. The reasons behind that are the system shutdown suddenly without any notes, so the users prefer to use paper files rather than the system to reduce the risks. Below a couple of quotations that show the views about trust and attitude using the system.

> *"There is no trust of using the system as the system shut down regularly which affect our work. That way we use the technology behind papers." (11-12, P2/KFH. Health professional).*

> *"Some case which is risky, it can be during surgery for example when we order laboratory test sometimes does not come through the system and if the system down. So, that makes huge risks for us. So, we have to use paper with the system, so we do checklist and notes based on paper in case if there any issues in the system." (46-49, P4/KFH. Health professional).*

One of the most common factors catalogued under social factors was cultural. Interviewees discussed cultural as a way of thinking and educating about using technology. There are people in Saudi culture who do not like using technology. According to interviewees, patients and health professionals were not accepting of the system during implementation. Thus, participant 1 indicated the reason that there were cultural issues because of the patients believe there is no trust in technology. Moreover, they only accepted prescription on paper when they were contacting with pharmacy while implementing the system.

> *"I think it is important to change the cultural the way of the people thinking about technology" (77, P2/KFH. Health professional).*

> *"The cultural issue was evident of patients who prefer using paper prescriptions rather than using electronic. They did not accept any e-prescription." (55-56, P1/KFH. Head of IT).*

Furthermore, users' age can be another social factor that influences the adoption of the system. During implementing the Medical-plus system, the IT trainers indicated that older users including both administrative staff as well as health professionals needed to improve their skills to use the system more than younger users. However, the IT trainers found that seasoned health professionals found it difficult to switch to the system.

> *"The main issues are the users who are old ages, and are not familiar with using the technology, and he/she is using the papers for a long time. They think writing on paper is very easy and quicker than using the system." (36-38, P3/KFH. IT specialist).*

Additionally, participant (5) indicated that the processing of using the system was slow because of the users who are old age health consultants prefer using paper rather than the system. Users, who were not agreed to use electronic medical record, have limited skill and experience dealing with technology. Many interviewees reported that user's age has a negative impact on adopting the technology. However, the young people can learn and improve the skills fast and easy to use the technology.

> *"I think using the system can improve the workflow and reduce it depended on the users. In fact, I think the main disadvantages are the users. They are not familiar with using the technology, especially with old health consultants, the skills of how dealing with technology and how to use the system are critical and unfortunately is very low." (33-36, P5/KFH. IT specialist).*

4.4.2.1.3 Organizational and administrative factors

Interviewees had different reactions to their experiences of management strategy in implementing the Medical-plus system. Interviewees' ideas of organizational and administrative factors can be divided into three broad views. Interviewees believed that there was a strategic plan to adopting Medical-plus; these plans were made to put a policy of using the system as the first stage. This helps to drive users to how to use the system rather than using the paper work. Top management in the King Fahad hospital joins the (JCI) as high-quality management, which required adopting medical record to the system.

> *"There was a policy for using HIT as we should be approved by international standard management communication and information and Joint Commission International (JCI) identifies, measures, and shares best practices in quality patient safety. One of the chapters in JCI included that we have to adopt technology to get approval. All hospital functions have to adopt the technology." (30-35, P1/KFH. Head of IT).*

In addition, participant (2) reported that there was a plan to link 30 hospitals in the same system and linked patient's data together with one electronic file. Then, the Ministry of Health planned to link with 60 hospitals over the country electronically. However, the main challenge was the organizational change for both decisions and people in top management, so there is no follow-up with the plans. As one of the managers said:

> *"There was a project to link top 30 hospitals in Saudi Arabia with 2 billion that included PCs and the core system. The second plan will be 60 hospitals to link with each other electronically. The challenge was changing ministers who modify the decision of adopting the project" (103-105, P1/KFH. Head of IT).*

On the other hand, interviewed with the participant 2 reported that there was not enough follow up with top management regarding adopting the system. There was no doubt that there was a challenge with top management to approve adopting the Medical Plus system project. Coordinating was a necessary stage for top managers in adopting the system. The below quotation is shown the point view.

> *"There is not enough follow-up from top management to use technology day by day" (9-10, P2/KFH. Health professional).*

Interviewees presented the second view by believing that senior management could be an essential factor in adopting Medical-Plus if they made clear policies and procedures. For example, top management designed declaration forms, to ensure privacy and security for using the system. Thus, the system helps senior management control against any illegal use such as sharing ID or passwords.

> *"The top management support us to implement the system by helping us to develop policies and procedures for adopting Medical-plus. We encourage users and patients to use the system by asking their doctors to write e-prescription only." (44-47, P1/KFH. Head of IT).*

> *"Any users must sign for conditional declaration form before they use the system. This able us to make sure that the system is very secure with high privacy. For example, if any user printed patient's exit letter from the system, by using the system we able to find the user and who access and when did the user print." (79-82, P1/KFH. Head of IT).*

The final view was that fewer resources were supporting top management to adopt the system. Interviewees expressed that the administrative difficulty in adopting the system was in both human and material resources. Interviewees approved that there were not enough PCs and networking solutions. That is clear when the top management encouraged both administrative staff and health professionals to communicate only via emails rather than using paperwork or fax.

"I think the new minister support us to use technology and first step he did, making us communicate by email and not using papers anymore. The new minister approaches to use health information technology. I think the orientation is right, but the problem of the resources that we have are not enough to achieve the vision to use the technology in health. For example, using e-miles in the hospitals between health professionals are not accessible because we do not have enough PCs." (90-96, P1/KFH. Head of IT).

Furthermore, participant 4 agreed with participant 1 that the main challenge was not having enough resources such as infrastructure while adopting the system. Thus, IT and human resources are main factors in adopting the "Medical-plus" system.

"I think there is the limitation of resources and IT infrastructures. I have to mention that there is a good support from IT department, they try to improve the system from time to time." (10-13, P4/KFH. Health professional).

On the other hand, Participant 2 disagreed with participant 4 and found that there are more than 5000 users on the system and only five IT support staff, which is not sufficient. In addition, IT staff have to run training programmes to support users overloaded with work.

"The IT department is doing a good job including training but five people I think not enough to support more than 5000 users in the hospital." (54-56, P2/KFH. Health professional).

Additionally, central decision-making based on financial budget, which is made by the senior management in MOH, has a negative factor for future IT development projects. This made improving the system difficult. Interviewees mentioned an example of this factor, which experimented when were ordered any computer devices, or wireless devices, which rejected from top management after a long time of process decision-making.

The reason behind that was in some cases; there are no enough budgets for developing and central decision-making in MOH. Below the quotation illustrated the view.

> *"I think all the hospitals budget that relate to the ministry of health have to be central decision-making by MOH that including the infrastructure, financial and resources. For example, we made tender for ordering computers and wireless devices; we rejected from top management because we do not have enough budget for development." (98-101, P1/KFH. Head of IT).*

4.4.2.2 Theme two: the impacts of HIT-related EMRs on health care

Another theme, which was evident, related to the effects of HIT, specifically EMRs on health care. These impacts included cost, time, privacy, safety, efficiency, procedure, and decision-making. Many interviewees agreed that using the Medical-plus system had a positive impact on healthcare organisations. Interviewees discussed the impact of Medical-plus on administration. Firstly, participant 1 mentioned that the main advantage of the system was improving the stock of the medicine as well as the demand. This benefit can help top management to make the decisions fast and easy. Additionally, participant 1 pointed out that using the system able to reduce cost and improve the work without using paperwork, which decreases the risk of losing data. However, he discussed the main disadvantage which the quality of the running the system because of equipment such as PCs reported shutdowns sometimes without notice. Furthermore, participant (5) agreed with the participant (1) about the positive impact on saving users time as well as reducing the medical mistakes, especially at OPD. On the other hand, participant (5) expressed that there was a high cost to implement the system in the early stage which recoding as a negative impact on adopting the technology. Following quotations describe the views.

> *"The main benefit of using Medical-plus is helping us to control dispensing of medicines. Also, it helps us to follow up with the stock." (58-59, P1/KFH. Head of IT).*

> *"It has some advantages such as less cost, fast and improves work without using paper. This will reduce the risk of losing patients' data. Let's highlighted the main issues or disadvantages; we do have the system shutdown. However, we do not face that issues regularly." (74-77, P1/KFH. Head of IT).*

> *"It is improved the health care, and the patients do not need to spend more time to talk with a doctor explaining the health history. Moreover, I think the system will able to reduce the cost of treatments" (29-31, P5/KFH. IT specialist).*

> *"I do not think there are risks of using the system, but I have to highlighted that linking the system with other health organisation will have positive impacts than negative and that will help to improve the quality of health serves by saving time and improving health care fast." (51-53, P3/KFH. IT specialist).*

> *"I think, the system will be able to reduce the time of visiting patients, as the doctors do not need to investigate the health record by asking him/her about health history. Also, it will reduce the medical mistakes" (74-76, P5/KFH. IT specialist).*

> *"There was a high cost to implementing the system at an early stage which impacts the King Fahad hospital budget negatively." (44, P3/KFH. IT specialist).*

> *"I think that the system improves the efficiency and health performances. Moreover, both clinical staff and patients feel trust and confidence of using the system." (71-72, P2/KFH. Health professional).*

Secondly, many interviewees discussed a positive impact of Medical-Plus on patient safety. For example, participant (2) considered the idea that using the system can improve the safety by reviewing the health history to find out any allergies or any diseases. There is no doubt that share patient's data between health organizations able to improve health safety.

Participant (2) strongly agreed that the system has to link to a different health organization for sharing health data among health professionals to improve health safety. Below quotients approved the views.

> *"I think the system has improved the safety of the patients as well as improving accuracy and availability of health information." (43-44, P2/KFH. Health professional).*

> *"I think the system has to be linked with other hospitals to reduce the risks and share patient's data will improve the health safety." (47-48, P2/KFH. Health professional).*

Thirdly, some interviewees discussed the idea that there was a positive impact of Medical-plus on the health privacy. Interviewees stated that they had no concern about data privacy as they have a high standard policy, which secures the patient's data. However, participant (3) expressed low risk in privacy if there is high control the access. Also, the interviewee by the participant (2) discussed the difference between using EHRs and traditional paper patients file related to the privacy effectiveness. In fact, using the Medical-plus is more secure than paper file as the system supported by password and ID to access the patient's electronic file. Thus, the interviewees stated that they would no risks reported in health privacy. The below quote encapsulates the opinion expressed by both health professionals as well as administrative staff.

> *"I think the system has no effected on the privacy; I think the top management can put high standards and protocols for integrating patients electronic file the system with private and public hospitals." (79-80, P5/KFH. IT specialist).*

> *"In my opinion using the unification file as electronic will have the positive impact and will improve the healthcare in Saudi Arabia. There are no challenges to adopting that, and I think no risk with privacy. Using the unification of the patient file will reduce the risk of high cost. Maybe, in the beginning, will highly cost but I think later will save cost. I think that will make a*

> *better statistic, reporting controlling diseases and better health care by the end" (62-67, P4/KFH. Health professional).*

> *"There are no impacts on privacy" (45, P3/KFH. IT specialist).*

> *"It supposed to be some risks of using the system, but I think there are low risks in the privacy especially if there is a good control to access the system." (57-58, P3/KFH. IT specialist).*

> *"No, I do not think so, using paper file will be high-risk that the system behind privacy. That because there are password and ID I think using patients file based on paper able anyone to view the file with no confidential." (61-63, P2/KFH. Health professional).*

Furthermore, participant (3) expressed the impact of Medical-plus on the accessibility of users. In his opinion, the main advantage of using the system is the ability to access patient's data anywhere and anytime. Participant's (3) experience of using the system for different needs has been a positive experience. Moreover, he approved that using the system can be secured and able to patient's data to be saved in case of losing or damaging. Following quotations explain the view.

> *"The positive of the system is the accessibility in which saving time for users and patients too. This is one of the main positive impacts of using the system in my opinion." (46-47, P3/KFH. IT specialist).*

> *"The advantages we can see is making the information easy to get by one click... Using the system will also able us to save and secure the data in case of losing or damaging the data." (29-30, P3/KFH. IT specialist).*

The interviewees showed that there was a positive reaction to their experiences of using the system. For example, participant (4) stated that the positive impact of using the system on healthcare is to be paperless. Also, both participants (4) and (3) agreed that using the system can reduce the time for both patients and clinical staff.

Interviewees agreed that the system is reducing the paperwork and improving communication too during treatments. One of the health professionals said:

> *"I think the main advantage is to be paperless. Also, it is saving time for both patients and clinical staff, improving communication between departments." (30-31, P4/KFH. Health professional).*

Interviewees had same reactions to their experiences of using the system. Health professionals who appreciated the system found that the system reduced the errors of non-clear handwriting. They agreed that understanding the diagnosis notes on the system is better than using paper. Also, they approved that the system able to solve the problem of bad writing and fast the health services. Alternatively, there were difficulty trusts with using the system as some time shut down. In this case; users need to be using paper that can be lost or not re-recorded in the system. Furthermore, interviewed by the participant (5) gave an example of his experience using the system, there was delaying that happened during the system down especially when was ordering necessary laboratory results. Following quotations show the view.

> *"I think using the system is much better than using papers. Because it will able to solve the problem of bad handwriting. I think using the system is faster than using handwriting." (36-37, P4/KFH. Health professional).*

> *"I think if the system shut down, it could be a risk during treatment and we have to use paperwork, and that can face the impact of bad handwriting as well as doctoral mistakes. Also, one of the impacts of the system down will be losing papers and delaying patient's laboratory results." (64-66, P5/KFH. IT specialist).*

4.4.2.3 Theme three: the model of adoption EMRs

The majority of the interviewees had a negative experience seeking the model of adoption Medical-plus. Participant (1) had the experience as head of IT to adopt the Medical -plus. The process was driven by different stages starting with introducing the system for users and applying several courses for both IT staff and users. Then the IT staff needed to be approved both hardware and software ready to test the system. In the beginning, there were lots of challenges such as cultural and familiarisation from using paper to use electronically. Additionally, participant (3) mentioned that there were no specific theoretical models or steps have used.

> *"Firstly, we introduce the system for users; we give them courses in suits time. We encourage users to have enough training. Our policy that we have is encouraging all employees to have enough training before applying for any vacation. After that, we test the system to approve all hardware should be ready to implement the system. There is no excepting for a health professional to use technology because of the cultural issues. Some of the users do not accept the technology because they thought it is not the main task they have to do." (21-26, P1/KFH. Head of IT).*

> *"There was no specific steps or models to implementing the system. Normally, we start to link pharmacy with all departments. We encourage users to prescribe for all patients throw the system. In my experience, we faced some challenges with users who did not accept the system. After that, we are implementing in the laboratory. All departments are integrated except radiology department which still using paper and PACs system" (19-24, P3/KFH. IT specialist).*

"The staffs of IT give us courses for how to use the system. There is no shared idea and feedbacks during implement the system." (21-22, P4/KFH. Health professional).

"Normally, the process follows up with the vendor who is the main work is to help to adopt the system. We always support the system by regular maintenance and fixing any technical issues. We normally support the system from small issues but the major issues we have to contact the vendor for more supporting. The vendor sometimes does not allow us to have full access to fix and improve the system. Moreover, I think the challenge for us, we have to improve the system by adding more models, and only it has to be done by cooperating with the main vendor" (17-22, P5/KFH. IT specialist).

4.5 Case Study Three: Saudi German Hospital

4.5.1 Background

Saudi German Hospital Al-Madinah Al-Munawara is private hospital. It started its operations in 2003. The hospital is fourth one in its chain of highly sophisticated, modern and fully operational hospitals in the MENA region (the Middle East and North Africa), committed to providing the best possible medical services, fortified by the highly qualified team of professional doctors, nurses and support staff in the region, medical equipment and team of internationally renowned specialists define the hospital. The entire spectrum of subspecialties is available under one roof. Combined with internationally acclaimed advanced diagnostic facilities, Saudi German Hospital's services and facilities are unparalleled in Madinah. With 184 beds, general hospital complying with the highest standards of medical health care, with latest technologies and specialised medical modern equipment. The hospital is in Madinah outside the Haram area conveniently located on Prince Naif bin Abdulaziz Road. The area is accessible to Muslims and non-Muslims.

The hospital aims at providing advanced healthcare at affordable prices primary, secondary and tertiary healthcare facilities, all less than one roof with best HIS technology. It works in collaboration with the largest hospital network in KSA that is the SGHG Hospitals, biggest European, American and Middle East universities. The high demand makes the hospital work 24 hours especially in an emergency department with the following facilities medication rooms. Also, it is accommodated 15 persons supported by highly qualified professional physicians.
The hospital is fully computerised with state of the art H.I.S (Hospital Information System) providing fully automated services to patients, staff, and the management.

The main health system that adopted is called VEPRO. It is developed in the headquarter in Pfungstadt close to Frankfurt, Germany. VEPRO established in 1981, manufacturing of PACS and EMRs solutions. VEPRO has specialised in the requirements of hospitals and practices by offering complete IT solutions for all medical areas such as radiology and cardiology. The company had successfully established a global reputation by positioning itself as an IT specialist, systems (VEPRO, 2010) .

The system has offered several technical advantages. Firstly, the system is applying the medical knowledge by using modern diagnosis and therapy. Secondly, establishing effective and efficient information and communication technology to improve the operational and medical services (VEPRO, 2010). Lastly, Expansion of medical education and training for improved quality of care in Saudi German hospital.

Furthermore, Saudi German Hospital in Madinah has been using VEPRO for ten years. There was no specific adoption model being used. Moreover, the IT department staff has been improving the system with limited financial support. On the other hand, the main challenge to adopt the VEPRO is the users. The clinic staff have less experience to use the technology, which makes challenging to adopt technology with less experience and knowledge. The main reason to use VEPRO is to deal with patients with less time waiting as well as securely saving patients data. Additionally, using VEPRO has to be supported all time, but because of the high cost of using technology, the Saudi German Hospital has to be self-develop. Interestedly, the system has linked to all Saudi German Hospital branches electronically, which make real advantages in the healthcare market.

4.5.2 The interview results

4.5.2.1 *Theme one: the critical factors influencing the adoption of HIT-related EMRs*

4.5.2.1.1 Technical factors

There was a positive result that participants were discussed the area behind technical factors. First of all, participants described the technical factor with variation point views. However, most of the technical participants agreed that VEPRO system had been challenged to adopt. In fact, the interviewees strongly emphasised that there be a good IT infrastructure including both hardware and software, which reduced the challenge. Furthermore, the data showed that the current hospital IT infrastructure must be eligible before a new system was adopted. Participant (1) believed that the technology is always changeable and need to be up today. This should be operated within currently available resources and equipment regarding solving the current technical issues. The equipment of the IT infrastructure means that the ability to update the system and functions with current inner resources, such as networks, servers, human, and PCs. Participant (1) said:

> *"The technology day by day is changing, and our hardware is not designed to accept the new technology." (32-33, P1/SGH. IT Assistant Manager).*

However, participant (2) pointed out that the current IT storage data infrastructure is excellent and support the VEPRO system. This can be able IT staff to confirm to be adopted any new technology and keeping update and back up the current health data, a participant (2) executive reported:

> *"So, we can save more data as the technology improves. There is enough and excellent IT infrastructure that we do have at our hospital." (34-35, P2/SGH. IT Backup System Officer).*

> *"Here in the Saudi German hospital, we have a digital machine which links to whole hospital departments with CER system that backup all data." (7-10, P2/SGH. IT Backup System Officer).*

Other interviewees explored another interesting technical factor, which is integrating the system internally with all clinical departments and externally with other branches. Participant (1) mentioned that the system integrated well with other branches to share health patient's data with a single file, by using a highly advanced technology system. As a result, the users able to access anywhere internally and externally within any Saudi German hospital by one file number. One of IT assistant manager said:

> *"Our system is the advanced system which integrates with all branches which can be accessed anywhere." (9-10, P1/SGH. IT Assistant Manager).*

> *"VEBRO has 37 models that integrated with all outpatient's services including lab x-rays models and doctor models. The system applies doctors to have all health record including prescription, diagnoses, etc. The system also reduces using paper "paperless."" (18-20, P1/SGH. IT Assistant Manager).*

In addition, the result shows that the IT department decided to develop the system by the internal resources. There was no reliance on suppliers "outsourcing" for developing or update the system. The reason behind that is the high cost that affects the hospital's budget, which required improving their internal resources.

> *"Yes, we can improve the system integration, but we need to have special integration system to develop the current system which can be extra cost from a vendor. Nowadays we are using our tools for integrating the system with another system that we develop in our department." (16-18, P2/SGH. IT Backup System Officer).*

Additionally, the IT staff approved that the technical factor is not challenging to integrate the system with any other system inside or outside the organisation. However, he strongly agreed that it would be great to incorporate the health data between other health organisations if there is same technical equipment and standards. Following quotation point out is an idea:

> *"There is no difficulty to integrate with any new system." (31, P2/SGH. IT Backup System Officer).*

> *"If the system integrated to be only one system, it would be a very good idea. Until now we do have two platforms systems for health data record one based on the images system from radiology department and health record files system, and they are separated" (38-40, P2/SGH. IT Backup System Officer).*

Furthermore, the interview's data is shown that IT staff had a positive impression regarding IT security. All the medical models in the system are highly secured. Thus, it showed a positive confidence using the system at all health services electronically. According to participant (1), the system is highly guaranteed by several security tools to protect health information based on the high priority of patient's safety policy. IT Assistant Manager mentioned as:

> *"We do have several security tools to secure our data because of the system easy to access anywhere" (10-11, P1/SGH. IT Assistant Manager).*

Another participant expressed the same view as a participant (1) when he emphasised the importance of hospital security system to help them to ensure fulfil the protection of health data policy. He said:

> *"I think it is important to secure patient's data and we have an excellent security system which reduces the risk of losing data or share with illegible users" (13-14, P4/SGH. Health professional).*

The interviewees emphasised the importance to improve the HIT of the current system. The data showed that the IT staff are working together to launch mobile health services which is a positive step in adoption HIT future technology. IT assistant manager explained this when he said:

> *"Then we started to develop the system by every single model by using different application tool. In future, we will launch mobile health services. It will take one year to cover all technology" (14-16, P1/SGH. IT Assistant Manager).*

Lastly, the data showed that clear hospital infrastructure and policies are essential to reduce any risk in case of system shutdown. The users have to back work with papers files. It is approved by top managers the main document can be used based on paper is prescription only. Interview data indicated a low risk of the system in case the system shutdown, which happened five years ago. One health professional explained that as:

> *"We use VEPRO as the primary system, but in the event, if the system shutdown, we have to go back manually which means using prescription by paper only. This does not often happen as last time happened before five years ago." (35-37, P3/SGH. Health professional).*

4.5.2.1.2 Social factors

The collected data revealed that there is less engagement on the part of the social factor, take for example the older age users and the needs of training which influence to adopt the system. The data shows that the older generation of health professionals avoided using clinical information systems as most of them struggle using paper files beside the system. Consequently, some health professionals mentioned that they had not undertaken any education programs about the HIT and their applications in a medical, educational environment particularly in a university as manager reported:

"During group meeting on a regular basis we discuss issues concerning the current system, we found that education is critical and this one of the most severe challenges we are facing with the health professionals because they have not taken any education programs at University in this area." (32-35, P5/SGH Administration staff).

Also, the data shows that there is different skills and knowledge in dealing with the current system. Subsequently, it is because of the variance in the user's age. The interviewees emphasised that there be regular training and presentation to develop users' skills to deal with the current system. As assistant manager stated:

"We have two kinds of users which include patients and health professionals we should give steps and teach them how to use the system. The age of users is making different for using the system we make training for how to use the system for the whole year we do everyday presentations to improve the user's knowledge too" (58-61, P1/SGH. IT Assistant Manager).

4.5.2.1.3 Organizational and administrative factors

The interviewees explained that, if a private healthcare organisation has to change human resources policy, it might have an adverse impact on the management quality of project concerning HIT. This is because there are always policy challenges from the MOH management strategic perspective. Take Saudization policy, for instance; the MOH has established the policy of the replacement of foreign workers with Saudi national in private sector. This because the majority of Saudis prefer to work in the government sector and the number of nonemployees has increased which makes the MOH push the private sector to be part of the solution of nonemployees. HIT project in Saudi German hospital has to deal with this challenge, which required changing human inner resources policy. IT Assistant management explained:

"For example, the government policy to give jobs only for Saudi nationality is the challenge for the human resource which affects our time." (34-36, P1/SGH. IT Assistant Manager).

Moreover, the hospital had terminated the contract with IT vendor after adopting the system. Therefore, the hospital was dealing with inner resources to cover a business need that was an obstacle and administrative challenges especially limitation of IT human resources for developing the current system. As IT assistant manager stated:

> *"…The vendor left the hospital since then we had to improve the system by our staff, that time the system did not cover our business needs and our IT health needs which increased day by day, and that was extremely challengeable" (12-13, P1/SGH. IT Assistant Manager).*
>
> *"We have less human resources which make our work to improve the system is very slow." (33-34, P1/SGH. IT Assistant Manager).*

The data exposed that there was a strategic plan for integrating medical data with other branches, which required having same data structures and IT infrastructure standards. In particular, ensuring the quality of health information workflow is needed to have complied with IT standards and same policy criteria. To integrate the adoption of HIT between the private and public hospital, there is requested agreement at the national level, which was including same strategic direction regarding the IT infrastructure, system standard and health data specifications. Interviewees point out that management plans should be designed to set and define the rules, policies and information specification which are needed to enable the exchange of health data crosses both private and public sector. Furthermore, the participants agreed about government's needs to take action to develop the policies of sharing health data. Regarding sharing health data with another hospital, it is required deciding on a community that mixes with different managers levels and various knowledge. Following quotients clarified the ideas:

> *"There is limited linked with us the public hospital. However, this link is without enough health data, and low standards policies as we have the entirely different system for health record system." (56-57, P3/SGH. Health professional).*

> *"The challenge for integrating the system is based on standards and regulation which should be controlled by MOH. We try to ensure that we have high privacy so that why we have to get permeation from our patients, and we think this based on patient's rights." (59-61, P3/SGH. Health professional).*

*4.5.2.2 **Theme two: the impacts of HIT-related EMRs on health care***

Most of the participants agreed that HIT has a positive impact on healthcare in the various areas. In particular, the interviewees data shows that there was a significant a positive impact on the accessibility of using the system. In this case, VEPRO system was linked with all departments at the hospital, which improve serving the patients in real time, which was better than requesting paperwork. It is mentioned in the following quotations:

> *"We can access it anywhere in the hospital and some cases, we able to get access out of the hospital." (10, P2/SGH. IT Backup System Officer).*

> *"I believe there is a positive impact of using the system, and clearly, we have many access points for the system which allows the health professionals to get the data." (48-49, P2/SGH. IT Backup System Officer).*

However, the interview with IT officer has given different point views regarding allow health data to be accessible from another hospital. He determined that there be a risk with linking the health data with any other hospitals electronically. Thus, the hospital has to control permission to provide advanced health data privacy, which secures healthcare data breaches and did not make patient data at risk. The participants agreed that IT accessibility has become a strategic aim for the hospital to reduce the possibility of privacy of patient health data. As a result, every user is required to hold an ID and password to ensure the privacy of using patient data. For example, two executive mangers said:

> *"In our hospital, we can give limited access to the other hospital to view the patient data if the patients permit us. For example, the X-ray images we can give a link to the user to see the images online. There is no access to labs." (60-62, P2/SGH. IT Backup System Officer).*

> *"The patients hold an ID number; this can give us full access to his/her health data for all hospital's departments" (10-11, P3/SGH. Health professional).*

Also, most the interviewees pointed out a positive impact that could be gained from the adoption of HIT-related VEPRO system on health care. Regarding security and confidentiality benefits, adhering to HIT policy can improve the privacy and security of patient's health data by facilitating the user's ID and password during workflow. As participants said:

> *"It is very high security because I only give specific people to access. We have the reliable backup system with only using his/her ID numbers to get all health history." (11-12, P2/SGH. IT Backup System Officer).*

> *"The crash, shutdown and, hacking are all example of the risk we cover that with different solutions. For example, we make backup twice a day. We do have servers to cover any crash during 30 mins transaction for backup. (22-26, P2/SGH. IT Backup System Officer).*

Moreover, there were positive impacts of using the HIT at different levels internally and externally. The results show that there was a highly secure system by using several tools to ensure high patient's data security. This would reduce a risk of stolen data or sharing with not authorised people. Also, the interviewees stated that there was a limitation of sharing data with external intuitions such as partnership organisation insurances, MOH, and both public and private hospitals.

The Saudi German hospital made clear rules and regulations for using HIT application. The main reasons behind that were to improve privacy concern. The IT department designed forms agreement to allow how and who is going to use the system as well as their responsibility. Following is an example of quotation, which illustrated the level of HIT impacts with similar point views:

> *"We do have our storage system which makes it possible to secure data which means that we have no risk of losing the data." (56-57, P2/SGH. IT Backup System Officer).*

> *"By using HIS, we limited the data that we able to share for improving the privacy there are rules for all users which be legally for using the system. We are improving the system which will cover the agreement between users and the patients for any data to access or shared." (43-45, P1/SGH. IT Assistant Manager).*

> *"The problem will be the equipment to adopt technology such as servers, PCs, regulation, and standards are entirely different with public hospitals. I think will be very hard because they should be same levels specifically the IT infrastructure and policies. What I think is an excellent idea to share the health data. However, I believe that it will have an adverse impact on the business owner, but if we think about the patients, it will have positive." (49-55, P1/SGH. IT Assistant Manager).*

Consequently, the governmental policy had shown a negative impact on the adoption of a HIT in several cases. For instance, the saudlization policy affected IT project, which required replacing the international workers with Saudi nationals. In term of saudlization, the human resources department had to deal with this challenge while was implemented the new system. Interviewees pointed out that any new policy always affects their time and making IT projects always delay finishing on time. For example, one manager said:

> *"The government policy to give jobs only for Saudi nationality is the challenge for the human resource which affects our time." (39-41, P1/SGH. IT Assistant Manager).*

The interviewees emphasised the importance to know the impacts of HIT on the health care before adopted with difference points. If senior management in the hospital knew the importance of updating IT infrastructure before taking the current system, the system can be linked to all departments, which allowed to get the value of using the system. Additionally, most participants agreed that one of the principal reasons for adopting the policy was facilitating integration with the different systems. This was because of controlling the drugs around all branches. Health professional said indicated the opinion of the importance of system integration with Saudi German Hospital branches:

> *"We do have a good infrastructure; the system is implemented as the requirement to have the high infrastructure, which linked with all hospital. ERP system helps to control the drugs around all branches." (47-49, P3/SGH. Health professional).*

Thus, integration has become a strategic object for the hospital to get the benefits of VEPRO application. Results show that any new system that can be integrated with any other hospital, needs to have same health system IT standard. However, at the Saudi German Hospital is not integrated with other hospitals and sharing the patients' health data. The main reason behind that is to improve the levels of security and privacy. Both administrative and health professional staff said:

> *"The risk of having a large data we use the compressing system which allows us to resize the images. Also of that, we support web linked with another hospital by email, we are carrying out the importance of improving the level of health data security. Also, we support CD for images that can hand it to the patients." (43-45, P2/SGH. IT Backup System Officer).*

> *"The drugs information system is the future system for allergy medicine that we will be implemented which reduce the risk of interference medication, and this system is in the high level of security" (20-21, P3/SGH. Health professional).*

There is agreed that HIT has positive impacts than negative. Participants mentioned that the main positive using HIT was to improve patient safety. It also could be reducing restricts drug interactions as well as determine the appropriate. Regarding patient safety, the participants agreed that the system could be given an alarm in the case of drug interactions increase dose. As a health professional pointed out:

> *"Firstly, I think the main benefits have increased the level of patient safety; it helps to use the medicines in the right way. Also, it is easy to access and able to get it anytime." (40-41, P3/SGH. Health professional).*

Moreover, the interviewees reported that there are significant positive impacts of accessibility of using the system. The result shows that the system has improved the availability of data on time electronically. Take statistical reports for example, by using the system the time of illustrating the demands and supplies of the medicines are reduced. Thus, top management makes their decisions on time efficiency and effectiveness. Furthermore, most of the interviewee pointed out the importance of using the system to get the right information and statistical report at the right time, which helps to plan and sharing the healthcare market. Consequently, using the system adds values regarding operational level, by improving the ownership data by facilitating the workflow. Also, regarding adding business value by using the system participants agreed that getting statistical data electronically on time was improved efficiency, work process, performance, and productivity. As one manager said:

> *"I think, the system has positive impacts especially on having medicine statistics report including demand as well as supply also the system can give us alarm if any medicines about to expire. Also, the system provides low stock and high stock medicines." (26-28, P3/SGH. Health professional manager).*

> *"This will improve the patient's safety, which reduces the risk of the mix up with any other patient's data." (17-18, P3/SGH. Health professional).*

> *"Using the system will contribute to improving the services to be quicker which better than using paper. By using the system will also help us to report medicines sales as well as procurement and that link with all branches in Saudi German" (51-53, P3/SGH. Health professional).*

> *"I think the main purpose of using HIT is to reduce time and cost by organising patient's data who are regularly visiting in OPD; the system is called VEPRO which is linked with all departments and units. The privacy is something important for us, so we take permission for any access to patient's data." (6-9, P3/SGH. Health professional).*

On the other hand, the results show that there was a limited disadvantage of using the HIT applications. The main disadvantage was reported is the time loading, the system sometimes takes longer to process any updating. In this case, the users have to work manually with paper files adding extra work time to treat patients. Additionally, users stated that if there would be any new system adopted or any updating happened during treatments, it could affect patient's time treatments and increasing the business cost to run the hospital. These are sequences that the HIT applications have distrust from users so far. Overall, the major of the participants agreed that HIT applications have a positive impact rather than negative impact on healthcare. One health professional said:

> *"The disadvantages, it can be in my opinion being time loading. However, rather than that the system has positive than negative impacts on health care" (40-41, P3/SGH. Health professional).*

4.5.2.3 Theme three: the model of adoption EMRs

The data showed that the staff in health organisation had a limited experience of adopting HIT applications. This because most of the medical staff was prefer using paper files rather than the system. Also, the limitation of knowledge that need to how implementation HIT applications affected the issues behind accepting the technology. So, having specific model plays a majority role in making the Saudi German hospital smoothly implementing the system and letting the users accepting HIT applications. In fact, the result shows that the organisation has used outscoring to adopt technology within limited participation with medical staff. Further, the communication skills show a positive impact, and it is playing a significant role in linking the administrative staff with medical staff regarding adoption and developing the current system if they need it. One health professional reported:

> *"In general, I think the main responsible for it is the IT department, but we give them the data. We are usually using both old and new system together in case of an update. There is good communication with IT department which improve and creating new models." (64-66, P3/SGH. Health professional).*

4.6 Case Study Four: Mouwasat Hospital

4.6.1 Background

This private hospital is located on the main airport road in Madinah. It is designed the highest quality of standards regarding buildings and facilities and distinguished by the 17,000 square meters area that the medical complex built. The hospital covers the following medical specialities 120 in patient’s capacity distributed over various patient rooms, including single and double rooms, in addition to the luxury suites 29 outpatient clinic. The hospital has a comprehensive and modern radiology department, including X-ray, CT, and MRI. In addition, scanning devices, ultrasound, and colour ultrasound and osteoporosis measuring unit. The department provides independent services to referred cases from other hospitals and medical centres in the area, as it is one of the best in Medina. Complete line of laboratory system (Clinical Chemistry, Hematology, histopathology and blood diseases). Although, medical laboratory department, which is a large department that offers services to hospital's outpatient clinics and internal departments. The hospital provides services related to medical analysis independently to cases transferred from other hospitals and clinics. Mouwasat Hospital in Medina provides various medical programs that aim to offer quality services to its clients. Experienced and highly skilled consultants visit the hospital regularly from many international and regional medical institutions.

Mouwasat Hospital in Madinah uses "HIS" by Cisco and iSOFT as the core system of EMRs three months. There was no adoption model used. IT department staff has been improving the system to meet the financial department needs. The main challenge to implement the HIS is the users. The clinical staff has less experience in using the technology, which made it challenging to adopt technology with limited skills and knowledge. However, the main reason to use HIS is to deal with patients' health needs with less time and improving secure patients' data. The HIS system has to be supported by headquarter (Mouwasat Hospital in Dammam) to help the IT department to develop the knowledge. It is noted that the system has been linked with all Mouwasat Hospital branches, which indicated a positive advantage in the private healthcare market (Csc, 2018).

4.6.2 The interview results

4.6.2.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs

4.6.2.1.1 Technical factors

The data showed that the new HIS system adopted three months by supporting internally and externally IT teams. The participants showed differences in their opinions including the function of the system, networking, IT infrastructure and backup system. For example, the majority of the participants indicated that the new HIS system made a significant change processing health care services. The IT department had to implement the system to be paperless, which is the main purpose of implementing the system. Additionally, the participants approved that the system transferred all healthcare data to be systematic that required designed electronic patients file. As one manager said:

> *"Now we fully use HIS, we were re-engineering the processes to be paperless fully systematic. All patient's data now based on the system we systematic work nowadays." (14-16 P2/MH. Administration staff).*

Furthermore, the participants explained that how did the system implement and how did technically challenging to deal with limited internal IT recourses. The result shows that there was an excellent technical support especially from the headquarter, which reduces the risks of errors. In general, the new models under HIS system had well implemented especially the insurance model. This model reduced the time to get approval from insurance companies and improving communication electronic. It is indicated that the main aim to implement the system was reducing cost and time wasting, which was reported below:

> *"The new system helps us to check patient's status fast if he or she has to get insurance approval" (13 P3/MH. Administration staff).*

> *"The new system is reduced the time to connecting with the insurance company to get approval." (11 P4/MH. Clinical staff).*

> *"The old system was not linked with laboratory department, pharmacy department.... etc." (29 P3/MH. Administration staff).*

Regarding IT infrastructure, the participants agreed that HIS system had been adopted with an excellent IT infrastructure including networking system, servers, and PCs. The hospital had high IT standards, which was able to adopt the new system with no IT risks. Furthermore, all IT infrastructures were supported by top management, which facilitated the stage of adopting the new system. The participants stated that there was no shutdown or crash in the system has been reported.

> *"We have an excellent IT infrastructure; the top management supports us with new equipment such as new printers and PCs which was essential for the new system." (28-30 P2/MH. Administration staff).*

> *"We do have HIS system which includes different functional, one of the first technical improvement is linked with insurance companies systematic. This system is beneficial to order the bills. We can share the bills easy with insurance companies and send to them. We use that system now for few months without any issues" (6-9 P1/MH. Administration staff).*

The interviewees showed that they were externally challenged to transfer from paper files to be electronic. In particular, the medical record department staff had to back up all paper files to the new system, which affected time implementing the new system. The hospital still uses both patient files based on paper and electronic files. Interestedly, participants found that working with both patient file based on paper and systematic is duplicating the work during treatments which wasting time, especially with regular patients. Furthermore, the users especially clinical staffs prefer using the paper file in some cases rather than the system specifically in case the system shut down. As the following quotations reported:

> *"The challenge to use the new system is the time that needs to implement it. We deal with both now papers and the system files in our department." (10-11 P1/MH. Administration staff).*

> *"The system has been loading us extra time which affects our time during treatments" (11 P4/MH. Clinical staff).*

> *"Until now we do not see any issues or problems regarding using the new system because we do have a high technology for a backup system. There is shut down sometime but we prepared us with it and we always notified by IT department." (55-57, P1/MH. Administration staff).*

4.6.2.1.2 Social factors

There were several social factors, which were reported from interviewees. Take communication channels, for instance, the IT department staff connected frequently with the headquarter to improve knowledge regarding implementing HIS applications. In addition, the participants agreed that the importance of having IT consultants. Thus, there was a limitation of knowledgeable staff in some stages; IT staff improved both international and organisational levels knowledge. The result showed that obtaining the services of IT consultants was a significant on looking at what value will get from adopting HIS and assess how the hospital is operating HIS. Moreover, the interviewees revealed that there were two main communication approaches, firstly IT vendor, which was the main resource, tapped into by the hospital to understand how to use the system and how to solve the regular IT issues. The vendor gives information about any updating and any up grading in the IT market. Secondly, IT department communicated with top management to allow getting membership for attending conferences, or site visits to some leading international hospitals, and having some courses. As shown in following quotation:

> *"As IT department, we are the main agency that deals with the implementing the new HIS system, we trained at the main branch about everything related to the new system and we support with the vendor for any difficulty. If we necessary to deal any issues or to improve our skills from any outsourcing such as conferences and international hospitals, we can contact them anytime." (32-35, P5/MH. IT manager).*

Furthermore, training was one of the significant social factors that influence to adopt the new HIS system. IT department staff trained in headquarter for practising and learning to how to solve any problem while implementing the new system.

Thus, The IT department staff has been internally training source to train and teaching at how to use the system for all employees to ensure using the system in the right way which able the organisation to get the benefits. The participants also highlighted some knowledge that barrier to deal with using the system that is the low level of English language some users have as the system only run by one language. As one of the managers said:

> *"The system is used for registration, health report, bills… etc. we give about three months training to how to use the system before fully implemented." (11-12, P2/MH. Administration staff).*

> *"The primary challenge was the system in English, and we have some staffs who have a low level of English." (25, P2/MH. Administration staff).*

4.6.2.1.3 Organizational and administrative factors

The data showed that the hospital purposed some positive results related to Organizational and administrative factors. In particular, the participants agreed that the top management had clear strategic plans related to HIT applications. The participants approved that the top management consciously the importance of having health information system to improve the workflow as well as supporting to achieve top management goals. The plan was to train users correctly before implementing the new system, which reducing administrative errors in the future. This draws the attention of how much is essential to have a plan before implementing and realising any new system. As one manager said:

> *"Our top management has apparently planned the training for us, and we had more than three months training before we implement the system. Moreover, I think that enough time." (25-26, P3/MH. Administration staff).*

Moreover, the participants agreed that they were supported by top management while adopting the HIS system. The top management was organising daily training based on the new system to ensure that there was flexibility training time. The users could choose their suits training time with IT department without extra working hours. The participants also supported with fully IT equipment, which was always ready for any updating. As one participant paraphrase that by saying:

> *"We have excellent support from the top management, the CEO gives us flexibility training time and supporting us with new equipment such as new printers which is essential for the new system" (40-42, P1/MH. Administration staff).*

As mentioned above the communication factor is a major factor in the implementation of the new system. The interviewees approved that there were various options to communicate with outsourcing. The users, especially in the financial department, were using an email to contact the insurance company rather than the HIS system, which some time was not electronically linked. The IT department staffs regularly meets with users to get their feedback to improve the level of patient's safety that the business required. Financial model for instance, if there errors or part of the model need to be improved such as interfacing errors the IT developers and users met up regularly to improve the errors. As reported below:

> *"As the financial department, we improved the system, but if we necessary to do any change we easy to communicate with IT department, we can contact IT department. We frequently communicate with insurance companies by email, and we are now more systematic by using the new system" (40-42, P1/MH. Administration staff).*

Furthermore, the data show that the new system has improved the various administrative and clinical actions related to workflow processes.

Top management in the hospital has been dealing with the old system for years without improving of the workflow process. Interviewees agreed those workflows such as lab results, x-ray results, and diagnose reports improved with the new system. The new system has also reduced administration errors such as electronic health insurance approval and printing the diagnostic report. The participants noted that the new system recovered the workflow processes to develop any complicated or complicated process for both workflow administration and clinical. Following quotations can be highlighted the point view:

> *"In my opinion, the system has improved the time that needed to spend to get lab results. Now we are automatically linked to the new system. The system has reduced administration errors. The system also is entirely liked with all departments in the hospital, which makes easy access for staff. We are not linked with other hospitals, so the outpatients have to open the new file with us even if has another file with any other hospital." (32-38 P5/MH. Administration staff).*

> *"The system has reduced administration errors. The system is entirely linked with all departments in the hospital which makes easy access for staff." (38-40 P3/MH. Administration staff).*

> *"As the clinical staff, we found that the new system is better especially during dealing with multi-tasks linked with all part in the hospital which makes easy to access for clinical staffs during treatment." (23-26 P4/MH. clinical staff).*

*4.6.2.2 **Theme two: the impacts of HIT-related EMRs on health care***

The interviewees emphasised the impacts of using the new system at internally and externally level. The data showed that the process of using HIS applications has a positive impact on patient's services as results of improving the process services communication with insurance companies. The participants stated that the new system reduced cost and time to get the insurance companies approval.

This was explained by one of the managers when he said:

> *"I think, it has a positive impact on patients. The process of approving from the insurance company the new system has improved the time to prepare this. The system is reducing cost as well as time issues." (40-42, P1/MH. Administration staff).*

Also, both administration and clinical staff showed that there was a positive agreement of using HIS system related to improving productivity as well as reducing treatment time efficiency.

However, in one word alone, both users and patients reported that they feel the difference with the new system, there are better services with less waiting time especially while getting an approval letter from insurance companies. The new system can also help to speed up health services effectively and efficiently to improve patient's care. Ensuring that patients information ready on time and only be entered once for immediately accessible by authorised clinical staff can do this. Following quotations stated the point views:

> *"The system has an active effect which improves the productivity and saves our time with more efficiency." (13-14 P1/MH. Administration staff).*
>
> *"I think the new system is better than before. It is improved patient's care saving time; we do not need to add health data again. In my opinion, the system is saving our time" (25, P2/MH. Administration staff).*
>
> *"The advantage of using the new system stop using paper anymore, which is going to reduce cost as well as to time. Moreover, I believe that the system has positive impacts." (33, P1/MH. Administration staff).*
>
> *"This system has made a significant change by making our work easier; this system also reduces time loud. I think the system reduced any errors that were in the past. In the beginning, after insulated, the system was many difficulties, but now the system is elementary to use." (6-9 P2/MH. Administration staff).*

Furthermore, the data showed that the new system reduced the risks and errors. Since the system adoption, it was agreed that there was no risks or errors had been recorded. An interesting fact, there was a second plan set in case of any risks or errors if the system shutdown. The majority of participants agreed that there were no risks or errors were reported since the system implementation. This gives a positive indication of the adoption of the new system, where most organisations fear the adoption of EMRs application. Following quotation explained the statement:

> *"Not really, there were no core errors have been found" (19 P2/MH. Administration staff).*

> *"I think the new system is clear. Moreover, it has no risks or issues as the new system has reduced the risks." (17-18 P3/MH. Administration staff).*

> *"There are no much changes, but it needs much concentration. There is no risk for any shutdown. We have the second plan which is using the paper temporary and re-enter it on the system again." (21-22 P2/MH. Administration staff).*

Another participant specified the importance of using HIS, which presented reducing the long and complicated process to get the benefit of using the new system. This also indicated that the top management reviewed the system before deciding to adopt it when he stated:

> *"In my opinion, there was a long process to get any health insurance approval we contact with two or more departments to get approval. However, the new system has improved the process and reduced it. It is now starting to be fully systematic as we planned well before adopted" (21-23 P3/MH. Administration staff).*

> *"In my opinion, the system has improved the time that spends to get lab results as automatically linked by the new system. The system has reduced administration errors. The system is entirely liked with all departments in the hospital, which makes easy access for staff. We do not link with other hospitals, so the*

outpatients have to open the new file with us even if has another file with any other hospital." (37-41 P3/MH. Administration staff).

Additionally, the participants agreed that the all departments have been linked electronically to reduce the use of paperwork. This is indicated that the system reduced employees processing time. The new system has shown that there were high-security standards and the patient's data confidentiality better than the old system. The results approved that the procedures got access only by permeation form that must be signed by a different department as an administrative rule to allow users to use the system legally. Following quotation reported that:

"Now the new system was linked entirely to all departments which save our time and patient's time too." (31-32 P3/MH. Administration staff).

"The new system is highly secure than old one, and every one of us has limited access to patient's data." (33-34 P3/MH. Administration staff).

On the other hand, other interviewees explored another interesting theme related to the disadvantages of adopting the new system, which will be discussed. The interviewees agreed that there were no single matters relating to the confidentiality or privacy has been reported. However, many administrative and clinical staffs concerned about the possibility that patients' privacy and confidential data can be revealed to someone who can be stolen or used in an unauthorised way for different reasons. One participant within the financial department declared that he is apprehensive about the fact that it is possible to access patients' data also from outside the hospital, especially if the system integrated with other hospitals. This is, of course, can be a better clinic and saving treatments time but can lead to financial data privacy in risks such as patient's data cost and budget.

Therefore, these data can be stolen, and external people can get the access to confidential data. Due to the consequence of this theme, privacy issues related to EMRs adoption mentioned further below:

> *"No, I do not think that able to happen. Because we should care about our confidentiality, privacy and patient's rights is part of our job, I think another hospital cannot be able to integrate either." (45-47, P1/MH. Administration staff).*

> *"The challenge to use the new system is the time that needs to implement it. We deal with both now papers and the system in our department. We are not optimistic to share the patient's data with other organisations because of the confidential and privacy" (10-12 P2/MH. Administration staff).*

> *"As you know, any new system is very challenging in the beginning as users are not used to dealing with it. However, by the time I think the system is going to be easy to use after a period." (21-22 P1/MH. Administration staff).*

> *"I do not think there are any positive impacts to integrate with any other hospital, in financial level, it can be the disadvantage, but for clinical data, it is going to be on the health professional's decision. What I think is good to share the clinical data with other hospital but need to be confidentially and secure". (49-52, P1/MH. Administration staff).*

4.6.2.3 Theme three: the model of adoption EMRs

The implementation of the new system was structured with several main stages. It started with IT strategic planning for all infrastructures that influence to adopt the HIS system. The IT department designed implementing the most relevant functions across the entire hospital. Further, piloting additional functions in single wards to test them continued this and got feedback from staff that were working on the selected wards. This helped to improve making any changes in light of results and advance achieved in utilising the framework.

Moreover, by choosing words for the pilot trial of the new functions, they could dissect how the framework functioned in various situations: inpatients, outpatients, and emergency ward. The following quotations show the main step to adopt the new system:

> *"We trained about how the system before to implement that from IT department. If we need more help using the system, we can contact IT department, as they are a great support for us. For an update, we get training from our vendor as well. We cannot improve the system by our self, so we should contact IT to request any change that we want to make it on the system. We swap to the new system in one month, but we did three months training, and I think was enough." (25-30 P1/MH. Administration staff).*

> *"I think there is no risk can be found, the privacy for us is something important, and I believe that we do not see that as a huge risk because all staff members have their IDs and passwords to accesses safely." (33-35 P2/MH. Administration staff).*

4.7 Cross-case analysis

The final step of the data analysis chapter is the cross-case analysis, which identified common findings across the four hospitals. Overall results were organised into tables, which classified the relationships into three themes, along with a description of the overall situation. Each case study provided significant results that need to be compared. The remainder of the cross-case analysis is organised into three themes: influencing critical factors, impacts, and the model of adoption of HIT-related EMRs.

The cross-case analysis was applied after in-depth analysis of the four compiled case studies. Twenty participants were involved, and transcripts of their interviews were recorded. The analytic process was similar to individual case analysis in that data from these sources were again grouped into themes related to the research questions. Common themes concerning these questions were identified, compared to the primary results of the discussion, and will answer the research questions below in the next chapter. Researcher consensus about the answers to the below questions was achieved through repeated supported discussion and reviewing of the primary data. The main research questions are:

RQ1. What are the critical factors influencing the adoption of HIT-related EHRs/EMRs in healthcare organisations?

RQ2. What are the key issues, impacts, and challenges in the implementation of EHRs/EMRs? Does the current Saudi healthcare system enable the integration of EHRs/EMRs between private and public hospitals?

RQ3. How are EHR/EMR systems adopted by different health organisations and what are their main impacts?

4.7.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs

4.7.1.1 Technical factors

The results show that there is an interesting difference between private and public hospitals regarding IT infrastructure. Both Ohud and King Fahad hospitals were built before IT was involved in health care services. These hospitals were redesigned to match the needs of IT infrastructure, such as new networking systems, servers, and the new department called E-health. Most of the participants in both hospitals agreed that the IT infrastructure affected the adoption of HIT-related EMRs. The results also showed that both hospitals had experienced shutdowns of the system during treatment for several reasons. Take updating the system, for example; there was a required shut down for updating. This indicates that there are experiences and skills that are necessary to deal with IT challenges. Also, both public hospitals show that there were old PCs, less networking, and a fewer number of PCs, which affects adoption of the HIT applications. The Medical-Plus system indicates that overload also affected the system, making it a slow process. This needs to be compared with private hospitals.

On the other hand, the technical factors findings at the Saudi German and Mouwasat hospitals suggest that there were positive results. Firstly, the IT infrastructures in both private hospitals are advanced, with no record of any IT problems. The participants for both hospitals agreed that the hospital was designed to accept the future of health technology and that all servers were up to date and the PCs were new. Furthermore, the participants believed there was enough IT equipment, which made the adopted system succeed. Secondly, both hospitals re-engineered their IT processes with different models to reduce paper use.

However, the Saudi German hospital has been using IT technology since the early 2000s. This means that it has much more experience using technology in healthcare more than any hospital in the Madinah region. The hospital is in the process of adopting mobile health services to add to this technology. Lastly, the IT infrastructure and equipment in both hospitals were always supported by top management, which means that the top management understood the importance of IT in the healthcare sector.

4.7.1.2 Social factors

There are many similarities and differences in participants' opinions related to social factors in all hospital cases. Take culture for instance, most of the participants agreed that users dealing with HIT applications in healthcare preferred paper files. Thus, there were negative social factors that related to adopting such HIT applications. Moreover, all interviewees accepted using technology on a different level, which depended on the age of the users. Most interviewees stated that older generations did not accept technology like the younger generations, which may be solved by training and educating them. This highlighted other essential sub social factors, including training and education as decisive factors, confirming that all interviewees need to have an attitude to learn and educate, a significant factor in adopting HIT applications successfully.

On the other hand, privacy is a factor that worries both private and public hospitals. Most public hospitals agreed that privacy is a concern and the hospitals interestingly care about patient's data. However, most of the users were in public hospitals; they thought that there were no issues with privacy if the system was integrated with another hospital. Moreover, in private hospitals, the views were different.

Most of the interviewees from the private hospital did not agree with sharing or integrating the system with another hospital. The reason behind that is privacy, especially of financial data. It seems that the private hospitals were more concerned about privacy than public hospitals.

4.7.1.3 Organizational and administrative factors:

Several administrative factors of all hospitals were asked about in the interviews had shown an interested result. Most of the interviewees in the public hospitals highlighted that there were long and complex procedures regarding decision to make any HIT application improvement. However, the private hospitals indicated different views; the interviewees positively reacted to decision-making from top management for any requirements needed in the HIT applications. All participants agreed that there was no doubt that HIT application improved communication with all management levels. Most of the interviews found that the inner recourses, such as human, financial, and IT equipment, were the main factors under the umbrella of organisation and administration that play an essential role in adopting the HIT application. The results across the four cases presented the reason for HIT application from administration viewpoints, which was to improve the workflow process and re-engineer the process, thus reducing administrative errors. However, the Saudlization policy was a concern in Saudi German hospital, which affects the management role of adopting HIT application.

In summary, most managers have positive beliefs that using the HIT application for accurate statistics is fast and efficient and improves management quality, especially in the levels of controlling and making decisions. The following table presents a summary of the critical factors influencing the adoption of HIT-related EMRs across the four cases.

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
Ohud Hospital case study	P5/OH Clinical Staff	• Saving time for both patient and clinic staff. • Some medicines are not available in the system. • The system shut down sometimes. • Using paper is difficult to read handwriting for some of the clinical staff.	• Using handwriting is based on the cultural • Having workshops from time to time to develop skills. • Having support from IT department.	• Transferring patients between hospitals fast. • Improving the safety and the services, especially in an emergency.
	P4/OH. Administration staff	• The system is more widely complicated and not narrow. • There is some information that not enough in the system. • Low IT infrastructure. • No enough infrastructure, there was some old PCs in some departments affecting the use of the system.	• IT needs more support to help implement the technology. • The main motivation to use system is to reduce difficulty in dealing with old file paper. • Key issues are the users; the users do not fill the entire gap in the system. • Have strategic that based on privacy and policy. • The head of the hospital targeting the use of less paper. • The policy and financial are challenging during implementing EMRs, changing the policy in public sector is taking too long.	• Have a list of evaluation, by using the system will help top management to see and manage the performance. • Have strategic that based on privacy and policy • The head of the hospital targeting to be less paper. • The policy and financial are challenging during implementing EMRs, changing the policy in public sector is taking too long. • It adopts a long time to approve from top management and sometimes needs to contact with Ministry of health to get approval.

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
	P2/OH. IT specialist	• The system sometimes shut down for ten mints, so the in effect for the trust users to use technology	• The training for IT developers is not enough. Which makes it difficult for supporting the users. • Contact with main vendor “Balsam” who able to support if there any issues.	
	P1/OH. Head of the E-health department.	• There was low infrastructural support such as new servers and networking there is only one server that we have the problem which shut down • Ohud hospital is ancient, rebuilding which able us to implement the system it still uses the paperwork • Key issues are the users who not able to accept the system. • Load of users with less network system and IT infrastructure	• The training and education of the clinical staff monthly. • Some issues regarding users are attitude some of the users do not accept the technology. • Have the problem with the old age health consultant who is not adjusting it to the system. • The culture is one important that accepts technology and users who will able to adjust technology. • Old users such as old clinical staff who not educated to use technology, will not accept OASIS. • Have a low number of employees in the E-health department, and that can challenge to adopt the technology • The hospital uses less paper file in future. • The plan is using the system especially for ordering medicine by online and linking all patient	• Online ordering medicine and improving control cost and demand. • Ministry of health to control the budget easily by using E-prescription. • Saving time and reducing the risk of damaging the file • Using the system will able us to have accurate statistics fast and efficient. • To have a low number of employees in the E-health department challenge to adopt the technology.

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
			data electronic this is will improve control cost and demand. • To help Ministry of health to manage the budget efficiently. • To save time and reducing the risk of damaging the file. • To have accurate statistics fast and efficient.	
	P3/OH. IT specialist		• IT staff has less experience, training, and employees. • In the emergency would be the risk to use technology. • Most of the clinical staff are not interested in the technology especially OASIS because it is overly loud. • The young generation is accepting the technology more than old users.	• There is no problem with financial or technology the problem is the staffs "user."
King Fahad hospital	P1/KFH. Head of IT	• Very weak infrastructure • Old PCs and less networking • Limitation of the number PCs • There is schooled maintenance to improve the PCs and the system. • Overload affect the system to be slow	• Users prefer using paper as part of the constructive trust.	• To be certified (JCI) • To improve the communication between all levels of management • Best quality management to adopt the technology. • To plan integrate health data with other public hospitals. • There is often management change which affects adopt the technology. • Top management is playing

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
				important rule to ensure having clear privacy and policy to use the system. • There were limited human and material resources during implemented the system. • Issues with Central decision-making.
	P3/KFH. IT specialist	• The networking in the hospital is very old • The PCs are very old • There are no issues with IT infrastructure • The system is very slow processing.	• The main sub factor is the age of user's old users are not accepting the technology. • To prefer paper file as easier to write and share.	
	P4/KFH. Health professional	• The system shut down regularly • Accessibility in the hospital is very limited • There is need to use paperwork in the emergency department. • There is no enough IT equipment.	•	• There were limited resources including IT infrastructures and human.
	P5/KFH. IT specialist	• Most of the PCs are very old • The IT infrastructure in the hospital is fragile. • The system is very slow processing.	• Old users such as old health professional are preferred using paper. • To have better skills to use the system	
	P2/KFH Health professional.	• There are no IT Issues related to the surgery department.	• There is limited training • Top management less supported	• No enough follow up with top management during

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
		• The main issues with the system are in the OPD. • Access is challenging to interlay and externally. • The system is less trustable because of IT issues. • There is no enough access point for the system. • Interfaces of the system is very complicated	• There was not enough education for how to use technology. • No trust of using the technology because the system shut down sometime. • Low attitude to use the system as users prefer to use paper behind the system. • Cultural factor is played a significant impact.	implementing and improving the system. • There were enough IT resources. • There was no enough IT support and low IT human resources.
Saudi German Hospital	P1/SGH. IT Assistant Manager	• The hardware was not designed to accepted new technology. • The system has linked with all departments the system linked with other branches. • The system has 37models that integrated internally and externally. • To improve IT security with several tools. • To lunch mobile health services.	• To teach users how to deal with the system and improving the skills. • The age of users is making different react of using the technology.	• There was an external policy that effect of adopting the technology which saudilization. • To improve communication with top management. • Difficulty with inner resources • There was no support for outsourcing. • Low human resources in IT department.
	P2 /SGH. IT Backup System Officer.	• There is excellent IT infrastructure. • The system has a high cost. • The IT recourses are limited • To improve the system the IT department, improve self-recourses.		

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
		• To integrate the system needs to have the same technical equipment.		
	P4/SGH. Health professional	• To have excellent society system to reduce the risk of losing data.		
	P3/SGH Health professional.	• To have hospital infrastructure and policies to reduce any risk of IT errors. • There was no risk of IT errors recorded, and no risk system shut down.		• There was limited link to another hospital. • The standards of the current system are a total difference with other hospitals system. • To have same standards and policies of using technology.
	P5/SGH Administration staff		• There are old users who not familiar with using the system. • Training to improve skills and knowledge • Education is an important to the segment to improve using technology.	

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
Mouwasat Hospital	P2 /MH. Administration staff	• To re-engineering the IT process with different models to reduce using paper. • There is an excellent IT infrastructure, which is advanced and up to date. • The IT infrastructure and equipment always supported by top management.	• To improve communications channels internally and externally • To improve healthcare services. • To the cultural is accepting technology so far • There is required training with headquarters. • There is IT consultant to support implementing the new system. • Low level of knowledge such as the level of English language. • There were more methods to learn how to use the new system.	
	P3/MH, Administration staff.	• To improve communication with insurance companies. • To support the system technically the IT staff liked with headquarters.		• The top management understands the need of using a HIT. • The part of archiving better health care services is to have HIT. • There was more than three months training before implementing the system. • There was a plan with top management about how to implement the system. • To reduce the administration errors.

Hospitals	Participants	The critical factors influencing the adoption of HIT-related EMRs		
		Technical factors	Social factors	Organizational and administrative factors
				• The system is linked all department in the hospital for better Follow up and monitor
	P4/MH clinical staff	• Technically the system still not linked with laboratory department. • Affecting time during treatments especially if there are any technical errors.		• Linked and communicate with all departments. • Strategic was planning for training and processing multi-tasking with one clinic in the system. • Having enough human resources.
	P1 /MH Administration Staff	• Technically using both paper file and the electronic file has duplicated the work. • There is no shutdown recoded		• Top management highly support IT department in implementing • To be excellent communication with all management levels. • To have better communication between IT department and users.
	P5/ MH IT manager		• The headquarter allows supporting IT staff • IT staff over regular bases training to improve user's skills. • To improve IT outsourcing supporting implementing the new system. • There was excellent communication with all users. • There was allows IT resource to support implementing the new system.	• IT department regular meet with users to have feedbacks to improve using the system. • To improve the workflow process and re-engineering the process which reduces the administration errors. • To reduce the registration errors • To have one file same in each branch.

Table 4-1: The critical factors influencing the adoption of HIT-related EMRs

4.7.2 Theme two: the impacts of HIT-related EMRs on healthcare

Most of the participants across the four hospital cases confirmed that HIT-related EMRs on health care have been positive in different aspects. Firstly, most of the participants stated that EMRs have a positive impact on patients' services related to saving time as well as cost by reducing the risk of damaging the patient's data. Secondly, according to the interviewees, using HIT applications such as EMRs will create fast, efficient, accurate, and easily accessible statistics to control the disease. Thirdly, the main reasons for using EMRs is to be paperless. This can improve workflow as well as healthcare performance and productivity. Patients' safety was also highlighted in the four cases as a positive aspect of using HIT applications. Interestingly, the results show that using the system across all four cases improved patients' data accessibility around the hospital. There are several other aspects regarding the negative impact of using HIT-related EMRs on healthcare across the four cases. Culturally, using technology in the healthcare sector was new in Saudi culture, as a developing country switching from using paper files to electronic records has negative impacts. In particular, users show less trust, and low attitudes were found using an electronic file in public hospitals. However, participants in private hospitals indicated that there was no cultural impact of using EMRs. Furthermore, privacy has been a serious concern in private hospitals, more so than public hospitals. Consequentially, EMR sharing with other hospitals will negatively impact privacy, especially at the financial data level. It appears that privacy has been highly secured in private hospitals, internally and externally. Lastly, health professionals in OPD approved that using both electronic and paper files together during treatments increases waiting for patient's time. The following table is presented as the summary of the impacts of HIT-related EMRs on healthcare.

Hospitals	Participants	The impacts of HIT-related EMRs on health care
Ohud Hospital case study	P1/OH. Head of the E-health department.	• To have a positive impact on patents. • Saving the patient data is more effective and efficient. • Using OASIS is helpful for statistic point view. • Making statistical report is easy to get via the system to help external side to make the decision. • To control the budget easily • To save time as well as reduce the risk of damaging the file. • Using system will able us to have accurate statistics fast and efficient • Using the system able to reduce using paper • The OASIS has high privacy, which allows the doctors only to get access to add details to the patient file
	P2/OH. IT specialist	• No impact on privacy in some cases • To share the data outside of the hospital electronically • The main impact is the demand of patients, especially on eye clinic
	P3/OH. IT specialist	• Improve education by teaching and training the users.
	P4/OH. Administration staff	• The paper file is more secure than electronic. • The users in the system able to change and adding data any time which makes the less secure and privacy • Using HIT is highly a positive and recommended to implementing to develop culture, • To catalogue and controlling the disease and make statistics report fast and easy. • Using system will control the cost of the hospital fast and easy. • To make the easy decision in the future. • To help plans the need for human resource in the future.
	P5/OH. Clinical staff	• It has a positive impact especially on saving time. • It is also making information very easy to find. • The system helps to follow up the patients' health history if the information if lose it. • The system contributes to following up the patients' health history in case the information loses it. • The disadvantage is when writing the quantity of medicine and sometimes notice that the system shut down. • It has more advantage than the disadvantage. • No impacts on privacy.
King	P1/KFH. Head of	• To help control dispensing of medicines.

Fahad hospital	IT	• To be less cost fast and improving health services. • Reduce paperwork and improve communication.
	P3/KFH. IT specialist	• Integrating the system with other hospitals will improve the healthcare • To improve quality of health care. • To save time and cost. • Implementing the system was highly cost • There are no risks to privacy. • To be able to access the data anywhere anytime. • The system has secured the data in case of losing or damaging.
	P4/KFH. Health professional	• To improve health care. • There is no risk in the data privacy. • To save cost and the time. • Using the system can have better statistic report. • To control the health diseases • To improve communication in the organisation levels. • To improve the errors of handwriting.
	P5/KFH. IT specialist	• To improve health care. • Reduce the medical mistakes. • Less time spending during treatments • To reduce health care cost • There are no risks in data privacy. • There is a negative impact on health care in case of the system shut down. • There is a negative impact on communication in case the system shutdown will affect the laboratory results.
	P2/KFH Health professional.	• To improve the healthcare efficiency. • To improve the healthcare performance. • To improve healthcare safety. • To follow up with diseases or allergies. • Integrating the health data with another hospital will improve health safety. • The system is more secure than a paper file. • There is no risk to privacy.
Saudi German	P1/SGH. IT Assistant Manager	• To share the data more secure • To improve the privacy

Hospital		• To link with patients and clinical staff • The system improves the health care fast. • To integrate the system, need to have same standards, regulations, and IT equipment. • It has negative impacts on Human resources such as Saudlization. • Governmental policy can impact the adopting technology negatively.
	P2 /SGH. IT Backup System Officer.	• To able to access the health data anywhere anytime. • To have a different access point for health data. • The system is improving the privacy and security • The IT prepared well for any IT risks. • The system is storing the data with no risk of losing.
	P4/SGH. Health professional	• To improve patient's safety. • Improve health care services with less time. • To have statistical report at right time • To improve the workflows.
	P3/SGH Health professional.	• To have access permission and secure the access to the system • To have high standards IT infrastructure which able to be linked to another health clinic. • Help to control drugs and the demand for medicines. • To improve patient's safety by reducing the risk of allergy medicines, • it can control the drugs and medicines better than using paperwork • to improve the patient's safety. • Reduce the cost and time of treatments. • The system update or errors can affect negatively during treatment
	P5/SGH Administration staff	• To improve healthcare efficiency and effectiveness. • To improve healthcare process. • To develop the healthcare performance and the productivity.
Mouwasat Hospital	P2 /MH. Administration staff	• To improve health services. • Reduce the time that used to process treatments. • Improve communication with insurance companies. • To reduce treatment cost. • To make work easily • To reduce the risk of administration and technology errors. • There was no risks or errors have been reported. • No confidently approved to use the system and integrate with other hospitals because of privacy.

	P3/MH, Administration staff.	• To improve productivity and reducing treatment's time efficiency. • The new system has reduced the risks and the issues that related to technology. • To reduce the long and complicated processes. • To reduce waiting results from lab and radiology. • There is no linked with another hospital. • To be more secure for using patient's data • To control access to patient's data.
	P4/MH clinical staff	• Highly security standards and patient's data confidentiality better than old system
	P1 /MH Administration Staff	• It has a positive impact on patents health care. • To develop products and saving time efficiency. • To be paperless which reducing cost and time • High risks integration with any other hospital. • Using HIT with another hospital will negatively impact on the privacy especially in financial data level. • To have a better healthcare
	P5/ MH IT manager	• Reduce the time that used to process treatments. • Improve communication with insurance companies. • To reduce treatment cost. • Easy to access • Improve decision-making. • To make work easily • To reduce the risk of administration and technology errors. • There were no risks or errors have been reported.

Table 4-2: The impacts of HIT-related EMRs on health care

4.7.3 Theme three: the model of adoption of EMRs

Analysis of the four cases shows that there were no clear models used to adopt EMRs. However, there were some stages with similarities across the four cases. Firstly, strategic IT planning in the early stages of adopting this technology is able to identify the IT needs before contact with outsourcing to support the adoption of the system. Introducing the system to users during implementation was the second stage. IT developers help set up with the user and develop the steps that users need in order to improve their skills. Additionally, there is a need for training all of the clinical and administrative staff in how to use the system. There is scheduled training for all users to ensure adequate skills to deal with the system.

Most of the participants agreed that supporting the system was necessary for regular maintenance and fixing any technical issues. Normally, fixing the small issues in the system required using only internal resources. However, for major issues, they had to contact the vendor. Undoubtedly, the vendor sometimes does not allow them to have full access to fix and improve the system. Lastly, piloting of the system before being fully implemented, and fixing any IT issues or errors found was done from time to time for updating.

On the other hand, there were some essential elements in adopting the technology that the four studies revealed. Take communication skills, for example. Most of the interviewees agreed that communication is an essential element to adopt the technology. In particular, communication with users and top management to get feedback and vendors to improve the system was of top importance. Also, most of the interviewees agreed that the IT developer helped set up the users to fix any IT issues. Lastly, most of the participants mentioned that using the HIT application in the health sector is new, and there are limited experiences and skills to adopt the system. The following table presents the summary of views related to the model of adopting EMRs.

Four different ICT systems were being used in the four case study hospitals examined in this research.

VEPRO is a Digital Imaging and Communications in Medicine (DICOM) compliant Web-based medical information that is used for practices of all hospital sizes. The system enables sharing and publication of healthcare data in the Saudi German Hospital. It also has an integrated physician portal, where staff can efficiently collaborate and share diagnostic images. The system offers a centralised location for the storage of all patient information, in the standard DICOM format. VEPRO and PACS is an open client/server system that can be expanded modularly, guaranteeing the investment security of the system. In Saudi German Hospital, the system used with technical integration with PACS and the electronic access to laboratory data. Therefore, the current system functions in the hospital were at the technical level for the exchange of health information across different organisations. Furthermore, other essential capabilities offered by the software include HIPAA compliance, appointment management, E/M coding, voice recognition, a patient portal, and HL7 compliant medical report image sharing which implemented perfectly in the Saudi German Hospital (Germany, 2010).

MedicalPlus is software tool for the proper handling of different types of radio diagnostic and health data services. The system supports the processing of all types of radiology department imagings, with support for images from CDs files, scanners, video sources and DICOM sources, all through to use graphical user interface where users can navigate through multiple levels of information. MedicalPlus in King Fahad is not integrated with PAC system to open radiology images in one system. However, the main technical advantage is adopting telehealth technologies. MedicalPlus provides functional for EMR services through comprehensive scheduling of exams/procedures and flexible workflow that covers all aspects of treatments. MedicalPlus able to drug-drug and drug-allergy interaction checks for medicines. The main technical advantage is that the system able to exchange with different public health organisations. The system can also be offered Health Level 7 Support for PACS integration and electronic appointment making particularly for outpatient (Medicaplus, 2018).

In addition, Open Architecture Specialized Information System (OASIS) is hospital management information system. OASIS has several models such as outpatient and clinic management, in patient's management, accident and emergency, medical file recording, medical records tracking, doctor's desktop, and nursing care, admin and patient care planning. Furthermore, by using SQL and related Query tools, can be made available to interrogate the database utilising user definable queries. During data entry, the user has the option to display the list of codes and descriptions and then select the appropriate code from the list. A spreadsheet and statistical analysis capability with interfaces to files maintained by application systems are available. It is possible to download the required data from the central database to the relevant packages for further analysis. It can be efficiently used in the Hospital environment to streamline the workflow within the Hospital. Currently, OASIS is used in Ohud hospital based on Oracle Version 9i. The new version has improved performance and takes full advantage of the advances in communication technology, local area networks and cooperative server technology. OASIS applications have several advantages; the main technical advantage is during data entry the user has the option to display the list of codes and descriptions and then select the appropriate code from the list. In Ohud hospital, the result was shown that there were no implemented of receiving electronic lab results through the OASIS because of technical reasons.

Lastly, HIS is a key component in viable health systems in Mouwasat hospital. The HIS 4.0 solution improves the quality of patient care using automation for clinical, EMR, administrative and inventory functions. In the process, HIS 4.0 also improves operational efficiency and reduces costs. The Clients have been using it successfully to handle in-patients, outpatients, accidents and emergencies, daycare and patient referrals, using service components, which include the Laboratory Information System, Cardiology Information System, Radiology Information System, Material Management System, Clinical Data Repository, and HIS Professional (CSC, 2018). In Mouwasat hospital, the main technical advantages of HIS is that better communication with insurance companies and outpatients. The system allows outpatients are making an appointment by web-based. The following table shows the comparison of EMRs/EHRs functionalities were being provided in the four case study hospitals.

No.	**Comparison of EHRs/EMRs functionality of four case studies**	**Ohud Hospital**	**King Fahad Hospital**	**Saudi German Hospital**	**Mouwasat Hospital**
		OASIS	**MedicalPlus**	**VEPRO**	**HIS iSOFT**
1.	Use CPOE for medication orders directly entered by any licensed healthcare professional who can enter orders into the medical record per State, local, and professional guidelines.	NO	YES	YES	YES
2.	Implement drug-drug and drug-allergy interaction checks.	NO	YES	YES	YES
3.	Maintain an up-to-date problem list of current and active diagnoses.	NOT GIVEN	NOT GIVEN	NOT GIVEN	YES
4.	Statistical reports.	NO	YES	YES	YES
5.	Record all of demographics (date of birth, gender, race and ethnicity).	YES	YES	YES	YES
6.	Record and chart changes Height – Weight- Blood pressure.	YES	YES	YES	YES
7.	Provide patients with an electronic copy of their health information (including diagnostic test results, problem list, medication lists, medication allergies, discharge summary, procedures), upon request.	NOT GIVEN	YES	YES	YES
8.	Incorporate clinical lab-test results into EHR as structured data.	NO	YES	YES	YES
9.	Integrating with PAC system.	NO	NO	YES, by using Web link	YES
10.	Using online appointment system.	NO	NO	YES	YES
11.	Integrating with mhealth, tablet PC, and Telehealth.	NO	YES Telehealth	NO	
12.	Capability to submit electronic data to immunization registries or immunization information systems and actual submission according to applicable law and practice.	NO	NO	YES	YES

Table 4-3: Comparison of EHRs/EMRs functionality of four case studies

Hospitals	Participants	The model of adoption of HIT-related EMRs
Ohud Hospital	P1/OH. Head of the E-health	• There is a model for every function • To implement the system on the OPD starting firstly with the prescription order model. • Explain and teach users. • By establishing the system checking. • There is no specific model or procedure. • The main step is the developer set up with the user and develops the steps that he/she needs to implement IT. • The developer can develop the system by changing models step by step with contacting the vendor.
	P2/OH. IT specialist	• The first step we have is distribution folded paper to explain the user about the system • Train all the clinical staff on how to use the system. • To improve the system, there is some feedback that comes from users such as choice medicines by brand name or scientific name.
	P3/OH. IT specialist	• Normally after implementing the model teach and training the users.
	P4/OH. Administration staff	• There were no steps. • Meeting with top management to make the clearance process to apply the technology.
	P5/OH. Clinical staff	• IT staff has no clear steps to how to implement IT.
King Fahad hospital	P1/KFH. Head of IT	• There were negative results related to adopting the current system • There was no clear stages or models. • Introducing the system to users during implementing was the first stage. • To train users how to use the system. • To improve familiarising to use the system. • To encourage users to have enough training
	P3/KFH. IT specialist	• There were no specific theoretical models to adopt the system • To encourage users to have enough training. • There is no linked with radiology department with current system
	P4/KFH. Health professional	• To have training courses regularly
	P5/KFH. IT specialist	• The process follows up with the vendor who is the main work is to help to adopt the system. • To support the system by regular maintenance and fixing any technical issues. To support the system from small issues. • To contact the vendor for more supporting the major issues.

		• The vendor sometimes does not allow us to have full access to fix and improve the system. • To improve the system by adding more models is challenging and only it has to be done by cooperating with the main vendor.
	P2/KFH Health professional.	
Saudi German Hospital	P1/SGH. IT Assistant Manager	• There were limited experiences to adopt the system. • There were limited skills to have such model to adopt the technology.
	P2 /SGH. IT Backup System Officer.	• Challenging to accept the technology
	P4/SGH. Health professional	
	P3/SGH Health professional.	• To adopt the technology, the IT department has to contact with outsourcing. • Communication is the main important tool to improve implementing the technology.
	P5/SGH Administration staff	• To use outsourcing to adopt the system. • Having high communication skill is very important during implementing.
Mouwasat Hospital	P2 /MH. Administration staff	• To ensure the privacy for patient's data are secured • all staff members have their IDs and passwords to accesses safely
	P3/MH, Administration staff.	• Strategic planning is the main stage. • Planning for all IT infrastructures that influence to adopt the system.
	P4/MH clinical staff	
	P1 /MH Administration Staff	• To train users about how to use the system before to implemented. • All stages to adopt the system are fully supported by IT teams.
	P5/ MH IT manager	• Designed implementing the most relevant functions across the entire hospital. • Piloting of using the system before fully implemented • Support users with schedule training. • Fixing any IT issues or errors

Table 4-4: The model of adoption of HIT-related EMRs

4.8 Conclusion

The findings presented in this chapter reveal much about the four cases in using HIT applications related to EMRs in both public and private hospitals. In the first instance, they tell us what factors that influence to adopt the health technology. The interviewee's results divided into three grouped factors, which are technical, social, and organizational and administrative factors. Furthermore, there was depth analysis related to the impacts of HIT-related EMRs in the healthcare, which illustrated in several aspects. The main positive impact was to improve healthcare by reducing both cost and time services. However, all cases indicated that there is a high risk of using patient's data, which is privacy in particular. It seems that there is awareness about the relevance of privacy and confidentiality issues related to the adoption and use of EMR systems, especially related to financial data at private hospitals. Important from both an empirical and a theoretical perspective to look at the research question (3) that based on the model that has been used to adopt health technology. Taken as a whole, the findings affirm there was the difficulty of doping the HIT because of no clear models and evaluation methods that have been used by E-health department to adopt technology which will be discussed linking with literature reviews. The fifth chapter is given over to the discussion of the main findings, their contribution will be presented to the existing body of knowledge on adopting HIT applications, and what they mean for future research.

Chapter Five: Discussion

Figure 5-1: Chapter Structure

5.1 INTRODUCTION

5.2 RESEARCH OBJECTIVES

5.3 DISCUSSION

5.3.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs

5.3.2 Theme two: the impacts of HIT-related EMRs on healthcare

5.3.3 Theme three: the model of adoption of EMRs

5.4 Lessons learnt from case studies

5.5 Discussion of the findings and implications for theory and practice

5.6 CONCLUSION

5.1 Introduction

This study investigated the impact of the adoption of HIT-related EHRs. It explored the acceptance of these technologies in four healthcare organisations in Saudi Arabia. The literature presented in Chapter Two showed a lack of research regarding the adoption of HIT-related EHRs. In particular, the research lacked focus on the following factors: impacts, risks, process, and evaluation of using such technologies in a healthcare setting. The research model adopted was built from a number of theories in the literature review in order to model the adoption process of HITs within a healthcare setting. The research findings, as shown in Chapter Four, were organised into four case studies, including twenty participants dealing with the implementation of EHRs/EMRs. In this chapter, these findings are linked back to the main objectives of the study. The structure of this chapter is outlined in Figure 5-1, and it begins with a summary of the research objectives. Following this, a number of ways to revise the conceptual research model for the adoption of HIT-related EHRs are examined. The evidence from Chapter four is then taken into consideration, and an overview of the main issues raised and lessons learnt from analysing the four case studies is provided.

The body of this chapter is organised into four sections that are related to the research questions, objectives, and research problems. The first section contains the critical factors that influence the adoption of HIT-related EMRs, as observed across the four case studies and the literature reviewed. The second section of this chapter covers the impact of HIT-related EMRs on healthcare. The third section of the chapter discusses the research model used to implement HIT-related EHRs. Finally, this chapter elucidates the real-world practices and theories behind ICT system implementation and adoption. The results of this chapter contribute to the proposal of a novel model for the adoption process of HIT-related EHRs.

5.2 Research objectives

The initial research work was focused on the development of metrics that could be used to assess the impact of management and organisational measures on technology implementation within a healthcare environment. The initial research focused on the development of EHR adoption and integration, in particular on the context within one country, Saudi Arabia. The objectives were:

1. To conduct a comprehensive literature review related to EHRs/EMRs and Saudi healthcare systems.
2. To review the existing models and consider how these models could be extended or modified to reflect the adoption process of HIT-related EHRs/EMRs at the decision-making stage.
3. To develop a conceptual model, based on the models identified in Objective 2, of the critical factors influencing the adoption of HIT-related EHRs/EMRs in healthcare organisations at the decision-making stage.
4. To determine current EHRs/EMRs adopted in Saudi healthcare organisations.
5. To assess how current EHRs/EMRs in Saudi healthcare organisations are adopted and are being supported.
6. To examine the roles of current EHRs/EMRs adopted in Saudi healthcare organisations.
7. To identify the impacts, issues and challenges of Health Information Technology (HIT) on Saudi healthcare organisation performance.
8. To identify the critical factors influencing how Health Information Technology (HIT) in Saudi healthcare organisations is adopted and is being supported.

9. To offer recommendations to help promote the adoption of HIT in different health organisations, to point out the limitations of this work and to indicate a direction for future work.

The first part of this research focused on developing metrics that could be used to assess the impact of eHealth technologies using social measures of technology within a healthcare environment. In particular, health technologies in Saudi Arabia are examined. To address the research objectives, the views of interviewees were sought on the significant impacts of HIT-related EHRs/EMRs.

5.3 Discussion

Once the data was collected and analysed, the cases were reviewed with participants to ensure that the results, based on case studies, were accurate and explained clearly. This step is recommended by Yin (2003), to reinforce the validity of the research results. This was particularly important, as the case studies, findings, and recommendations were later sent to the MoH in Madinah to support decision-making related to EHRs. Furthermore, this chapter aims to form a link between current literature and the findings of the case studies in order to answer the research questions. This was done to improve the validity of the results, as they may be consistent with, or different from, the results of other relevant studies. Consequently, the results were analysed, and three themes emerged: factors, impacts, and theories to adopt HIT-related EHRs/EMRs.

The main findings of this research were based on factors identified in a research framework model, including the risks, barriers, and impacts of using EHRs in both private and public hospitals. The case study results did not demonstrate that a clear model was in place that could show how to implement technologies in healthcare in Saudi Arabia.

5.3.1 Theme one: the critical factors influencing the adoption of HIT-related EMRs

This section seeks to discuss the critical factors influencing the adoption of HIT-related EMRs by considering pre-existing theory and then synthesising the main literature review with the results of the four case studies. The following discussion highlights the similarities and differences between the results and those found in previous literature.

*5.3.1.1 **Technical factors***

Most scholars agree that the main technical factor influencing the adoption of EHRs is IT infrastructure (Chen *et al.*, 2012; Cresswell and Sheikh, 2013; Lian *et al.*, 2014). IT infrastructure can include both hardware and software, which are designed and required for an organisation to adopt HIT's. The work of Lian *et al.* (2014) showed that linked healthcare organisations are required to have the same level of IT infrastructure. This was supported by the findings of Chen *et al.* (2012), who also showed that health organisations need to build and organise in a structured way to enable their IT equipment to adjust to healthcare system demands. Additionally, Soliman and Janz (2004) argue that data security and privacy are technical concerns to be considered when adopting HIT-related EHRs. This includes all health data such as personal data, laboratory data, radiology data, and diagnostic data. The complexity and compatibility of IT and IS can also affect the adoption of HIT-related EHRs (Boonstra and Broekhuis, 2010; Lin *et al.*, 2012; Liu, 2011).

Most studies identified the primary technical factors as the often limited computer skills amongst users; the limitations of the system; a lack of customizability, resulting in a system that does not meet user requirements; a lack of reliability (e.g., crashes) and interconnectivity with existing systems; and a deficiency of hardware to support EMR (Boonstra and Broekhuis, 2010).

Most of the results from the four case studies discussed the IT infrastructure from several viewpoints. From the results, an interesting difference between private and public hospitals was observed regarding IT infrastructure. Both Ohud and King Fahad hospitals were built before IT had become a part of healthcare services. These hospitals had to be redesigned to match the needs of current IT technologies such as new networking systems and servers. However, participants from Saudi German and Mouwasat hospitals claimed that the IT infrastructures in both private hospitals were advanced, with no record of any IT problems. Furthermore, participants in both of these hospitals agreed that the hospital had been designed to accommodate future health technology innovations; all servers were up to date, and PCs were new and equipped with the best networking systems. Additionally, the participants believed there was enough IT equipment, which helped in the successful adoption of the system. While these hospitals had re-engineered their IT processes with different models to reduce healthcare cost and time, the Saudi German hospital had been using IT technology since the early 2000s. This meant that it had much more experience in using technology in health care than any other hospital in the Madinah region. This hospital is currently in the process of adopting mHealth services, to improve its health communication services. Within the two private hospitals, top management understood the significance and value of using IT in the healthcare sector.

Points of similarity between the literature and the case studies can be observed. Firstly, IT infrastructure was the main issue when it came to the adoption of HIT-related EHRs. Within the two public hospital case studies, IT infrastructures were complex and not well supported, while the private hospitals displayed more advanced technology and up-to-date IT infrastructure, leading to significant differences in success levels of HIT implementation. This is echoed in the literature (Chen *et al.*, 2012; Cresswell and Sheikh, 2013; Lian *et al.*, 2014).

In addition, there were different patterns of use between the two private hospitals and the two public hospitals. In Mouwasat hospital, for instance, the IT department discussed how essential re-engineering processes had been while implementing the system. This included re-engineering processes such as workflow and documents to reduce the complexity of the healthcare process. Indeed, this was supported by the literature (Boonstra and Broekhuis, 2010). No participants mentioned privacy and security as technical concerns. However, there are not enough studies to show the differences between private and public hospitals regarding technical factors in adopting health technology.

5.3.1.2 Social factors

According to Thompson *et al.* (1991), social factors are behaviours present when dealing with technology, which includes skills, age, gender, experiences, and culture. These factors were mentioned by most of the participants, in particular in the King Fahad case study. The participants discussed a number of social factors, which can be linked with the previous literature. In terms of cultural factors, for example, interviewees in King Fahad hospital highlighted a cultural concern which can affect implementing HIT. Some users in the hospital preferred using paper files rather than electronic health records because of their cultural perspective. This matches the arguments of Cho and Larose (1999), who noted that users have different knowledge and cultural backgrounds which can affect the implementation of technology. In addition, patients and health professional's attitudes toward innovation (Keshavjee *et al.*, 2006; Ludwick and Doucette, 2009; Yarbrough and Smith, 2007).

A significant relationship between communication and the adoption of HIT-related EHRs has also been shown. Keshavjee *et al.* (2006) indicate that relationships and communication are significant social factors influencing the adoption of information technology. For instance, the management and stakeholders who are dealing with IT projects have to be regularly contacted during the implementation of the system in order to successfully adopt HIT (Keshavjee et al., 2006). This exactly matches the results shown in the case of Mouwasat hospital, where the participants believed that it was necessary to communicate with all users to improve skills and solve any issues, and in the development of HIT projects. Robert *et al.* (2010) believe that, the better the communication skills between users and IT developers, the better the adoption and application of the system, and vice versa. This assertion has also been confirmed by other studies, such as Gruber *et al.* (2009), who believe that the sharing of information, and open communication channels, can help to ensure that the system is valued and used correctly by health professionals and patients. These studies agree with the results of the case studies. Both private hospitals case studies demonstrated a belief that it was essential to communicate while implementing the new HIS. The participants in the IT department agreed that it was important to communicate with headquarter to offer support during the implementation.

Furthermore, according to Cresswell and Sheikh (2013) and Yusof *et al.* (2007), training is among a list of several social factors which contribute to successful HIT adoption and implementation, such as firm leadership, technical support, response time/turnaround time, information accessibility, information relevance, clarity of system purpose, user involvement, user training, user perception, user skills/knowledge, user roles, clinical process, champion/medical sponsorship, internal communication.

This has been supported by several studies identifying social factors, including training and user development, as an essential factor in the adoption of HIT (Boonstra and Broekhuis, 2010; Cresswell and Sheikh, 2013; Ludwick and Doucette, 2009; Yarbrough and Smith, 2007). Interestingly, the users in public hospital thought that there would be no issues with privacy if the system were integrated with another public hospital. However, in the private hospitals, the views were different. Most of the interviewees here did not agree with sharing health data or even integrating the system with another hospital. The reason behind that this was the risk involved with financial health data.

5.3.1.3 Organizational and administrative factors

According to Kuan and Chau (2001), changing government policies can affect management strategies, as well as decision-making within hospitals, which also influences IT strategic planning. However, government policies can be encouraged to use HIT in different ways. Most scholars agree that it is important to have similar public policy standards between all health organisations. The results show that government policies such as the Saudization policy, which aims to replace foreign employees with Saudi employees to solve the issue of Saudi unemployment in the private sector, has affected the adoption of HIT-related EHRs. Additionally, the work of Cresswell and Sheikh (2013) indicates that having a management structure is essential to enable restructuring and acceptance of new technology. However, most interviewees from the four case studies agreed that there was no shared policy standard set up by the MoH.

According to Gagnon (2010), the redesign of workflows allows for the provision of adequate training and support to users, and problematic issues surrounding the redesign of workflows are an example of an organisational and administrative factor.

This is also addressed in the case study of Mowasat hospital, as it is shown that the new system has improved the various administrative and clinical actions related to workflow processes. Top management in the hospital had been dealing with the old system for years without improving the workflow process. As a result, most of the interviewees agreed that workflows such as lab, x-ray results, and diagnostic reports had improved with the new system. The new system had also reduced administration errors such as errors with electronic health insurance approval. The participants noted that the new system "HIS" recovered the workflow processes to develop any complicated or complex process for the workflows of both administration and clinical:

> *"In my opinion, the system has improved the time needed to get lab results. Now we are automatically linked to the new system. The system has reduced administration errors. The system also is entirely linked with all departments in the hospital, which creates easy access for staff. We are not linked with other hospitals, so the outpatients have to open a new file with us even if they have another file with any other hospital." (32-38 P5/MH. Administration staff).*

> *"The system has reduced administration errors. The system is entirely linked with all departments in the hospital which makes easy access for staff." (38-40 P3/MH. Administration staff).*

> *"As the clinical staff, we found that the new system is better, especially when dealing with multi-tasks linked to all parts of the hospital, creating easy access for clinical staff during treatment." (23-26 P4/MH. clinical staff).*

Keshavjee *et al.* (2006) argue that there are essential management stages, involving IT strategic requirements, before the implementation of a HIT. The first stage is initiated with the implementation of an investment strategy from top management, which involves approving the vision, mission, and allocation of resources. Therefore, leadership should always create an implementation team. These needs to consist of IT projects managers, health management and users.

Looking at the case study results, the results showed that there was an IT strategic plan for the integration of medical data with other branches, which required having the same data structure and IT infrastructure standards. In particular, ensuring the quality of health information workflow when discussed acknowledged the importance of IT standards. It was found that to integrate EHRs between private and public hospitals, there is a need for an agreement at a national level, to have the same strategic direction regarding IT infrastructure, system standards, and health data specifications. Interviewees point out that management plans should be designed to set and define rules, policies and information specifications, which are needed to enable the exchange of health data across both the private and public sector. Furthermore, participants agreed on the need for the government to take action to develop policies regarding the sharing of health data. It was shown in the case studies that sharing health data with another hospital requires a decision that needs to be made at a high organisational level with the input of many different managerial levels and different knowledge:

> *"There is no linked with us the public hospital. However, this link is without enough health data, and low policy standards as we have an entirely different system for health records." (56-57, P3/SGH. Health professional).*

> *"The challenge is facing the integration of the system is based on standards and regulations which should be controlled by the MoH. We try to ensure that we have high privacy standards, so that is why we have to get permission from our patients, and we think this is an element of patients' rights." (59-61, P3/SGH. Health professional).*

Interestingly, making IT strategic was not only effective regarding planning but also communication, conflict resolution, the participation of stakeholders and the motivation of users. Communication with all users was essential to address and fit in with their needs. It is important to understand the challenge of changing from traditional healthcare to involving health technology, which is difficult from a managerial point view; however, it can be overcome by addressing barriers and communicating the benefits of the new solution.

According to Keshavjee *et al.* (2006), who investigated the integration between different systems, a new system integrates effectively with existing ones by predetermining how paper records will be entered, and by addressing issues surrounding standardisation. Additionally, usability must be considered for both hardware and software, which also needs to fit in with existing work processes. For instance, EHR systems are often complex, resulting in reduced usability; thus, usage requires extra time to complete some actions, and involves intense learning on the part of the user; additionally, usability can be improved by flexible technology such as tablet computers.

Overall, these factors need to be considered to understand how to adopt IT successfully in the healthcare industry. The research results have shown that all participants agreed that there was no doubt that using HIT applications improved communication with all management levels. Most of the interviews suggested that internal resources, such as human, financial resources, and IT equipment, were the main components, under the umbrella of organisational and administrative factors that played an important role in the adoption of HIT.

The results of the four case studies illuminated the reason for using HIT, from an administrative point of view, which was to improve and re-engineer the workflow process and reduce administration errors. However, the aforementioned Saudlization policy was an important factor within the Saudi German hospital, affecting negatively the adoption of a HIT. Consequently, most of the managers have positive outlooks, believing that the use of HIT can provide fast and accurate statistics, to help improve management quality, especially at the level of controlling and making decisions.

5.3.2 Theme two: the impacts of HIT-related EMRs on healthcare

In the literature review, most of the studies looked at the impact of HIT on health care systems, with different views. These were discussed from the perspective of impacts on the healthcare delivery process, on the people working within the organisation, on patients and relationships with other stakeholders (Brynjolfsson and Yang, 1996). Additionally, there was some literature provided which demonstrated that the main impacts of HIT on the healthcare system were economical. According to Brynjolfsson and Yang (1996), economic evaluation is one method of evaluating the impact of health information technology, by comparing projected incomes and costs. However, it has been established that this process of estimating the value of ICT is inconclusive since it does not consider several factors.

Among the results gathered from the case studies, the investment in IT was never directly mentioned. Thus, it can be inferred that investment in IT within healthcare has been a low-level priority. This is because the cost of IT is increasing and the related financial resources have been reduced, particularly in public hospitals (Alkhamis, 2017). Most participants in public hospitals agreed that financial resources had not been effectively and efficiently used, especially those in relation to IT.

In effect, in Saudi Arabia, the main financial resource is oil, and because the price of oil products has recently decreased, the government has been taking action to cut costs in EHR integration projects within the public healthcare sector (Almalki *et al.*, 2011). Indeed, healthcare systems, and the financial resources employed in the adoption of EHRs, differ between countries. For instance, Ireland is a democratic country, where the populace is able to accept and reject any government decision. This is because the primary financial resources and funding of the government depend on taxes paid by the population. As a result, the adoption of EHRs in such a country could be a challenging, and long process of decision-making. In Saudi Arabia, the government runs all hospitals and the decision-making is undertaken by the government with less democratic input. Additionally, Saudi Arabia faces a complex context, with a fast-growing population (Yusuf, 2014), posing a challenge to its health care services. Moreover, recently there the number of diseases in Saudi Arabia has increased, further affecting the health care sector (Al-Daghri et al., 2011). On the other hand, factors such as fear and mistrust of EHR technology by the general public especially regarding personal privacy concerns can be found not only in Saudi Arabia but also in countries such as Ireland.

In addition, other studies have highlighted that there is a strong need for a model to evaluate information systems from a financial point of view. There is no doubt that having such a model to show the impact of information systems on healthcare would be a major way of bringing value to healthcare. For example, the implementation of computerised order entries by physicians, and electronic medical records has potential impacts on quality, cost, and efficiency in health care.

Interviewees reported that there had been significant positive impacts on accessibility following the implementation of the HIT system. The results showed that the system had improved the availability of data, making it faster to access also. Taking statistical reports as an example, it can be observed that by using the system the time taken to collate the demand and supply of different medicines are reduced. Indeed, top management makes its decisions on time efficiency and effectiveness using such a financial evaluation tool. Furthermore, most of the interviewees pointed out the importance of using the system in order to get the right information and statistics at the right time:

> *"I think the system has positive impacts, especially on the ability to get medicine statistics reports including demand as well as supply. Also, the system can give us an alarm if any medicines are about to expire. Also, the system provides information on low stock and high stock medicines." (26-28, P3/SGH. Health professional manager).*

> *"Using the system will contribute to improving the speed of services, which is better than when using paper. Using the system will also help us to report medicine sales, as well as to help with procurement and the creation of links between all branches in Saudi German" (51-53, P3/SGH. Health professional).*

Interestingly, the results from public hospital interviewees show that there were no electronic means in place to evaluate the financial side of healthcare. The use of the system was reserved for health record history. This indicates that public hospitals were not using the technology to its full potential.

Most researchers have highlighted that the adoption of EHRs enables the improvement of patient safety by avoiding a lot of errors in drug prescriptions (Abdelhak *et al.*, 2014; Bates *et al.*, 1999). According to Cannon and Allen (2000), using EMRs can allow for clinic staff to receive automatically generated alarms, alerts, and reminders, which have a positive effect on the quality of patient care. Laing (2002) showed that users such as nurses found that the benefits of EMRs took the form of, the standardization of nursing language, the provision of specific data, extensive database integration, and improved information management processes. However, the study by Likourezos *et al.* (2004) found that users of EMRs in an Accident and Emergency Ward stated that EMRs had an adverse impact on patient care because the system could lead to confusion and increased delays.

Thus, looking at the results, top management in King Fahad hospital joins the (JCI), which can be classed as high-quality health management. This requires the implementation of medical records onto the system. It was clear from the interview with top management in King Fahad hospital that EHRs had a positive impact on patient safety and quality of care:

> *"There was a policy for using a HIT, that we should be approved by the international standards of communication and information management, as well as the Joint Commission International (JCI) which identifies, measures and shares the best practices in quality patient safety. One of the chapters in the JCI included that we have to adopt technology to get approval. All hospital functions have to adopt the technology." (30-35, P1/KFH. Head of IT).*

Furthermore, many interviewees discussed the positive impact of Medical-Plus on patient safety and care quality. For example, participant 2 considered the idea that using the system could improve safety, as it allowed for the reviewing of health history to discover any allergies or diseases. Participant 2 strongly agreed that the system should be linked to different health organisations in order to exchange health data between health professionals and thus optimises healthcare safety:

> *"I think the system has improved the safety of the patients as well as improving the accuracy and availability of health information." (43-44, P2/KFH. Health professional).*

> *"I think the system has to be linked with other hospitals to reduce the risks and to share patients' data will improve the healthcare safety." (47-48, P2/KFH. Health professional).*

Chaudhry *et al.* (2006) stated that the impact of HIT on the quality of healthcare had been comprehensively examined. According to Chaudhry *et al.* (2006), in terms of quality measures, average quality was higher for hospitals with electronic health records and computerised physician order entries. The major impact of HIT on quality of care is its role in increasing adherence to guidelines or protocol-based care. Also, as the studies of Chaudhry *et al.* (2006) have shown, quality of care has improved through clinical monitoring based on large-scale screening and the aggregation of data. Additionally, it has been shown that this technology leads to a reduction in medical errors.

However, privacy and the security of health data have been identified as a major concern in the implementation of EHRs (Bates, 2005; Hersh, 2004; Sprague, 2004). This is an issue in the case study examples also. For example, participant P4/OH administration staff in the Ohud hospital disagreed with participants 5 and 2 about the risks surrounding privacy. He stated that paper files are more secure than the electronic system. He believed that using paper files would reduce the amount of access. This meant that there would be no access to any points in the hospital as the current OASIS system allows. Another argument for the use of paper files was security, as medical staff cannot physically modify and change patient data when using paper files. Additionally, this means that health professionals' mistakes can be reduced. A list of statements made by participant 4 is presented below demonstrating these points.

> *"The privacy of data by using traditional techniques, I mean paper files, is more secure than when using electronic files. There are several reasons behind this; the main reason is the reduction of the number of individuals accessing the file. Also, by using the system, it will be possible to access the file anywhere in the hospital, so the information is not secure" (74-77, P4/OH. Administration staff).*

> *"The users of the system can change and add data at any time, which makes it less secure and decreases privacy." (79-80, P4/OH. Administration staff).*

> *"Using paper would reduce the doctors' mistakes any health data more safely and legally for the patients. Also, the system can help to follow their records easily." (82-83, P4/OH. Administration staff).*

However, interviewees from King Fahad hospital stated that they had no concerns about data privacy, as their hospital has a high standard of security, which ensures the safety of patient data. Participant 3 did express that there were low risks related to privacy, but that these were moderated by the hospital's high control of access.

Additionally, participant 2 discussed the improvements in terms of privacy effectiveness when using EHRs, compared to paper files. Medical-plus is more secure than paper files, as the system is protected through passwords and IDs, which are needed in order to access the patient's electronic file. Thus, most interviewees reported no risks when it came to health data privacy. The below quotes encapsulate the opinions expressed by both health professionals and administration staff.

> *"I think the system does not affect privacy; I think the top management can put high standards and protocols in place for the integration of patient's electronic files into the system, which can be linked between private and public hospitals." (79-80, P5/KFH. IT specialist).*

> *"There are no impacts on privacy" (45, P3/KFH. IT specialist).*

> *"There are supposed to be some risks related to the use of the system, but I think the privacy risks are low, especially if there is good control over access to the system." (57-58, P3/KFH. IT specialist).*

> *"No, I do not think so, using paper files would be more high-risk than using the system when it comes to privacy. That is because there are passwords and IDs, while I think using paper-based patient files enables anyone to view the files with no confidentiality." (61-63, P2/KFH. Health professional).*

Regarding the impact of HIT on the efficiency of healthcare, Chaudhry *et al.* (2006) claim it contributes to the efficiency of care and good time management. Tierney *et al.* (1990) have shown decreased rates of health service utilisation, as computerised order-entry systems provide decision-making supports at the point of care where the primary interventions are taking place. While the studies of Tierney *et al.* (1993) and Overhage *et al.* (2001) at the Registries Institute showed increases in physician time spent using computers, studies by Wong *et al.* (2003) and Pierpont and Thilgen (1995) showed slight decreases in documentation-related nursing time, due to the streamlining of the workflow.

Additionally, studies such as those conducted by Neame and Olson (1997) have shown that there is a need to share clinical information to develop the safety, continuity, integrity, and speed of delivery of patient care. According to Laing (2002), the development of EMRs supports the more widespread use of clinical data exchange. Thus, statistical data will be easy and fast to analyse, and decision-making will be aided and sped up, and easily accessible.

There is an argument surrounding the impacts of HIT-related EHRs on the healthcare system. Most of the literature findings suggested that using HIT-related EHRs has a positive impact on healthcare organizations, in terms of time and cost saving. According to Van Der Loo *et al.* (1995), using EMRs can make collecting data easier and faster than using paper files.

This is agreed with by Thompson *et al.* (2009), who state that using by EMRs it is possible to share patient health information more quickly. As a result, sharing patient health information by EMRs can reduce geographical barriers, as well as serving a purpose of record integration, specifically in fragmented health systems, thus improving continuity of care (Pagliari *et al.*, 2007).

Furthermore, the results indicated an interesting point of view, which needs to be discussed in unison with the literature review findings. While most of the interviewees agreed that using the system could be advantageous in terms of time and cost, some interviewees stated that it takes time to use the system in the hospitals. Some of the PCs in use are very old, and some system functions are complicated. A small number of interviewees stated that they had difficulties using the current interface of the system, which in turn also affects patients waiting in the OPD.

Therefore, this is among the reasons why some hospital staff users choose to use paperwork rather than the system. Indeed, some staff interviewees expressed negative views on their experience with dealing with the system, related to the time it takes to use:

> "*There are many issues when using medical plus. However, I would like to highlight the main issues; there are too many sections in the system that we have to fill in, and that makes us unable to see all OPD patients on time. I found that if we use only paper files, rather than the system, this helps us to serve more than 15 patients in the day, but with the system, we are only able to serve ten patients." (33-36, P2/KFH. Health professional).*

However, most researchers agree that using EMRs can lead to cost-saving, through the decrease of unnecessary prescriptions or repeat testing. The study of Joos *et al.* (2006) showed that there is an apparent gain here, as EMRs can reduce the time needed to improve a patient's synopsis, which could lead to a significant cost saving. According to research carried out by Likourezos *et al.* (2004), one scientific investigation found that clinic staff were able to finish tasks much more quickly than before by using EMRs. In line with these findings, the results of the case studies indicated that many interviewees assumed that using the system would have a positive impact on cost:

> *"Using HIT has been highly positive, and I recommend its implementation to develop our culture, it will help us to catalogue diseases and make statistic reports quickly and easily. Using the system will allow us to reduce and to truck the cost quickly and easily. It will also make it possible to make decisions easily in the future. Also, using the system will help to reduce the need for human resources in the future. I think that using the system will help us to monitor the need for medicines and how much we need in the future." (91-96, P4/OH. Administration staff).*

> *"I think that it will help to reduce the risk of medical mistakes, make statistical numbers easy and fast to collect so that the top management make their decisions in real time. In the private hospitals, unfortunately, they are looking to make money rather than serving the patients. So, if there one files the doctors will not ask the patient for more money, as can happen due to cost increases when ordering lab or radiology tests. If the system is linked with other private and public organisations, it will help to reduce cost, time …etc." (100-106, P4/OH. Administration staff).*

In terms of patient empowerment, researchers investigated a variety of effects that HIT-related EHRs have on the healthcare system. The studies of Tsai and Starren (2001), for example, found that patients who had connected with EMRs had reduced their total number of clinical visits and developed healthcare outcomes. Furthermore, studies by Chin and Mcclure (1995) and Wright *et al.* (1997) found that communication technologies have different methods to connect with patients in order to supply higher quality care.

Additionally, Littlejohns *et al.* (2003) have been able to use an evaluation programme to show that EMRs can improve the accessibility of patient related information. It also showed that using EMRs could improve patient empowerment, by developing a procedure through which individuals have more control over choices and activities influencing their health.

In the case study findings, the use of EHRs was shown to improve patient empowerment. Indeed, EHRs can improve the ability of patients to recognize their role, by participating electronically and using EHRs online to follow up on their health and monitor diseases. In addition, using EHRs can develop knowledge and skills in health-care by providing continuing education. However, most of the interviewees agreed that the current system was affecting engagement with patient's due to privacy issues.

Furthermore, all of the systems observed in the case studies are based on internal communication channels, involving only administration and health professionals. This indicates that there is no access for outpatients to use the system via an external communication channel, to improve patient empowerment.

When it comes to clinical governance, according to the case studies, the adoption of EMRs can improve and support clinical decisions, as well as communication. Both Smith (1996), Kelly (1998), and Goodman (2000) find that sharing clinical information makes it possible to support the continuity, integrity, and speed of patient care. As a result, it can improve workflows, as well as healthcare performance, productivity, and patient empowerment. On the other hand, several negative impacts of HIT-related EMRs on healthcare could be observed across the four cases. Using technology in the healthcare sector is a new idea in Saudi culture, and as a developing country, switching from the use of paper files to electronic records has specific negative impacts. In particular, users show less trust; thus, negative attitudes were found among those using electronic files in public hospitals.

However, participants in private hospitals indicated that there was currently no cultural impact to using EMRs. This is despite the fact that privacy has been shown to be more of serious concern for private hospitals than public hospitals. Indeed, it appears that privacy has been highly regarded in private hospitals, both internally and externally. Using EMRs shared with other hospitals will have a negative impact on privacy for these organisations, especially when it comes to financial data.

5.3.3 Theme three: the model of adoption of EHRs/EMRs

It was obvious from the literature reviewed that different approaches exist in the implementation of EHRs/EMRs. It is essential, initially, to highlight that there are differences between private and public hospitals regarding the model used to implement EHRs/EMRs. Indeed, it has been demonstrated that implementation in the public sector is a more complicated process than in the private sector, especially during the decision-making and adoption phases.

Work has been carried out when it comes to establishing a model for adopting EHRs/EMRs in the healthcare sector, by the international healthcare advisor, HIMSS Analytics, which offers guidance and IT solutions for better E-health. HIMSS Analytics has designed a model to help both hospitals and health professionals evaluate EMR adoption through the EMR Adoption Model (EMRAM). According to HIMSS Analytics, The Electronic Medical Record Adoption Model (EMRAM) is based on an eight-stage (0-7) model for the adoption and utilisation of the EMR functions required to achieve a near paperless environment which harnesses technology to support optimised patient care (Hersh and Wright, 2008).

An analysis of the four case studies shows that there were no clear models being used for the adoption of EMRs. However, there were some stages of adoption observed which showed similarities across the four cases, which can be highlighted. Firstly, across the four cases, strategic IT planning was there in the early stages of adopting the technology, in order to identify specific IT needs before beginning the process of outsourcing to support the adoption of the system. Additionally, introducing the system to users during the implementation process constituted the second stage in the Ohud case study. IT developers met with the users and developed an approach to system integration.

Additionally, there was a period of training for all the clinical and administrative staff on how to use the system. There was scheduled training for all users to ensure they had enough skills to deal with the system. Across the different hospitals, most of the participants agreed that support for the system was necessary via regular maintenance and the fixing of any technical issues. Sometimes, it was necessary to contact the vendors, who do not allow the health organisations to have full access to fix and improve the system. Lastly, in each case, use of the system was piloted before fully implementing it, and from time to time the system was updated following a period in which IT issues or errors were addressed. Additionally, across the four cases, it was agreed that an essential element in the adoption process was the use of excellent communication. Indeed, most of the interviewees stated that effective communication, particularly communication among users, top management, and vendors, in order to get feedback and improve the system, was essential during the adoption of the technology. Lastly, most participants across the four hospitals mentioned that the use of HIT was a new process in their organisation, and that they had limited experience and skills when it came to adopting the system.

5.4 Lessons learnt from case studies

An outline of the key lessons learnt, from the descriptive data, is given in this section. This section does not offer prescriptive guidelines for the analysis of different aspects of HIT-related EHRs (such as their impacts, factors, risks, and models). Rather, it describes how healthcare organisations are dealing with core systems such as EHRs/EMRs. It also offers an in-depth understanding of the HIT situation in private and public hospitals in Saudi Arabia. This allows other organisations to relate their experiences to those reported here.

Several significant lessons were drawn from this research, for both public and private healthcare organisations. These also contribute to the work of future researchers and other groups of participants.

Lesson one: Organization of IT standards and implementing EHRs: While several government entities and commissions spoke of standards, no one has taken the lead either privately or publicly in improving and encouraging them in Saudi Arabia. Consequently, only a few organizations have demonstrated high enough standards to adopt EHRs. In the case studies, this was clearly seen in the private sector rather than in the public sector. Additionally, every health organisation studied was at a different stage regarding the implementation of EHRs, as the systems used by each organisation were different. The needs and expectations of healthcare organisations to use technology to improve healthcare were identified. Furthermore, EHR standards were restricted, and the systems were built without proper infrastructures in place. It was found that having no clear IT infrastructure standards in place can hinder adoption of HIT-related EHRs.

Exchanging health data semantically among health care providers is possible. However, extracting meaningful health information through health reports and accurate statistics is limited by the inefficiency of the health data system. Hence, producing medical statistics and reports, for example, diabetes statistics, in Saudi Arabia, is difficult and is of serious concern.

Lesson two: The possibility of a national plan for EHR integration: The case studies showed that a plan exists for health data exchange among healthcare providers. These cases show investment in healthcare IT, specifically in areas such as advanced clinical information systems, networks, and platforms. This investment does not bring any focus on standardisation, which would enable organisations to exchange health data. The Saudi Arabian Ministry of Health has established a national plan to integrate EHRs only between public health providers. The implementation of this plan faces several difficulties. Indeed, the integration of health information between different health organisations in Saudi Arabia is a project that is not able to succeed at present for several reasons. For instance, different healthcare providers run a variety of different IT infrastructure setups, which makes it a challenge to link them, and professionals in Saudi Arabia are unable to deal with the complexity of health information technology related to EHR integration. This was supported by all four case studies. Additionally, the national healthcare system is not sufficiently organised. The case studies show clearly that EHRs are not well structured and organised to be able to share and exchange data between healthcare providers. Moreover, there are concerns about the confidentiality and privacy of patients' health information, as there is no clear health confidentiality and privacy legislation in Saudi Arabia.

Lesson three: A long-term plan for the management of health information: No organisation observed in this study has an official plan for the management of health information or any committee assigned to agree on how to share health information and meet matching IT standards. Accordingly, all cases show that there are not enough human resources to improve the use of HIT. The plans are typically short-term and involve limited resources, especially within the IT departments in the cases. Most of the experiences in Saudi Arabia of adopting HIT-related EHRs have occurred within the last five years.

This indicates that there is not enough experience to make plans, especially when there is low job creation in IT healthcare in Saudi Arabia. The case study hospitals within the private sector tend to show better plans for EHRs and system updates. This is because the market is very competitive, which encourages private hospitals to improve their services by using technology. IT departments in the private sector demonstrate a use of limited resources but are better at targeting objectives; however, in the public sector, a high use of resources and low ability to target objectives is observed. These issues will be discussed later in this chapter.

Lesson four: Skills to adopt HIT-related EHRs and lack of national professionals. The IT professionals who work in Saudi healthcare organisations should have advanced skills in health information systems. There should also be a ready supply of internal IT professionals. However, as observed in the case studies, most organisations employ only external consultants. This is because there are limited knowledge and experience related to the sharing of health records, in particular between private and public hospitals. The case studies show that advanced health information system integration is a new concept to many of the participants. Regardless, most of the participants in this study showed an interest in adopting such systems. Every case study had begun opening some communication channels with international consultants. They have done this to seek support in selecting the process for using technology in healthcare, such as m-health. Furthermore, education institutions such as universities and colleges recently established educational programs to improve knowledge and skills related to information communication technology in healthcare, with a particular focus on new fields such as E-health.

Lesson five: The trust of the health information systems market: all case studies show that integrated EHRs are not available. No single system is compulsory or legislated for in any of the case studies. In Saudi Arabia, every hospital has its unique procedures, policies, and systems. For instance, Ohud and King Fahad public hospitals in Madinah are located next to each other, yet they are using completely different systems. The health organizations provided by the Ministry of Health must ensure that new systems and health data conform to certain standards, in order to integrate them into the same infrastructure. Moreover, the HIT market in the case studies has shown that there are vendors who customise systems and designs without adhering to international standards, which affects the future process of integrating EHRs successfully.

Lesson six: The abilities of the current IT infrastructures: Within the public hospitals studied, there were concerns among IT department managers related to the hospitals' IT infrastructure. These individuals believed that the hospitals were built before the involvement of IT in healthcare. Thus, challenges were faced when it came to implementing modern IT networking and servers in such old hospitals. For this reason, there were concerns about government-established commissions for any new technologies, EHRs standards, and advanced applications. The IT department managers in private hospitals displayed no concerns over current IT infrastructures. This is because these hospitals were built within a market environment, which required them to improve health services continuously and to stay relevant. Furthermore, these hospitals have already completed significant investment projects regarding HIT infrastructure to improve health data standards. The reason behind this disparity between public and private health sectors is that there are no general health data standards.

As each hospital has different standards from the others, this affects the successful integration of systems between different healthcare organisations. Most of the participants interviewed clarified that the main challenge to the adoption of a HIT in old hospitals is that they were not built to accommodate the use of technology in healthcare.

Lesson seven: Advanced systems are being applied less effectively in public health organisations than private health organisations: Many of the advanced systems being adopted in the case study public hospitals are proving ineffective because of the workload they entail. In the public hospitals, for instance, clinicians use fewer functions in EMR/EHR applications because of the large number of patients attended to, especially in the OPD. The users believe that time is an issue during patient visits to the OPD and that the use of paperwork rather than data entry into EMRs allows more patients to be seen. This indicates that users are not showing an interest in the advanced systems health organisations is investing in. In addition, IT managers do not have the power to push users into implementing advanced systems, which could be used more for healthcare efficiency. Additionally, participants in this study who work in public hospitals stated that most of the PCs used are old and unable to run up-to-date systems. In contrast, private hospitals have shown that they are more technologically advanced and better at dealing with health technology.

Lesson eight: Low engagement of health professionals: There was less engagement among health professionals and nurses when it came to using the health record systems on a daily basis. The reasons for this were their heavy workload and low level of EHR/EMR education and training.

IT departments are essential resources for training, providing workers with the skills, and knowledge needed to use the system. It was concluded that top management should engage users to implement the EHR/EMR systems put in place via several health producers and policies. For example, the King Fahad senior management dictated that the pharmacy receives only patients who have an electronic prescription and do not accept patients with paper prescriptions. However, some policies and health procedures cannot be continually used on a daily basis because of system issues. For instance, when the system is down, which sometimes happens, these organisations must return to using paperwork. Additionally, the system always has to be updated, which affects its users' abilities to be sufficiently systematic, and they need to be continually trained for any updated system. It was found that any change in using EHRs must be by cooperation between clinical and administrative staff.

Lesson nine: Healthcare organisation management: Issues that may arise during the implementation of a HIT are the relationship between clinical and administrative staff and the power struggles between them in hospitals. It was found that top management should create a balance in its organisational structure between health professionals and administration staff. It was found that this could start in the public healthcare organisations first. This is because of the high degree of bureaucracy and politics that come into play in public hospitals. Furthermore, the better collaboration is between the administrative and clinical staff, the better flexibility and decentralisation there will be. For example, decision-making in public hospitals currently requires a long process before approval, which is only possible with permission from the MoH managers' headquarters. These are responsible for the majority of financial decisions related to IT projects.

There is a limited number of authorised administrative staff who have the power to decide to adopt HITs. However, in private hospitals, there is fast decision-making and more flexibility in this regard. This is because of the market forces, which push organisations to seek improvements and advantages continuously to compete.

Lesson ten: The healthcare organisations' type, size, and culture: Links between private hospitals, public hospitals, and premier care exist based on geographic and population considerations. Furthermore, the MoH is responsible for managing healthcare organisations and should push such organisations in Saudi Arabia to adopt EHRs. The lifecycle of only one patient in a tertiary clinic may sometimes require complex treatment, which means that there is a need for strong communication channels and linkages with a variety of doctors and support staff. The medical language must be reliable, and the information must be synchronised between the different doctors with a specific end goal to boost the success of the treatment and to diminish medicinal mistakes. Additionally, the Saudi Arabian MoH is one piece of a multi-social structure. Having a non-institutionalized therapeutic dialect in the healing centres requires a considerable number of people preparing the program. This was considered by most participants to be one of the key difficulties confronting the centres in Saudi Arabia.

Cultural influences were found among the health professionals, administrators, and patients based on gender and age. For example, for cultural and religious purposes, female patients prefer only female doctors and nurses for medical examination. Language is also a cultural issue, especially in the Madinah region; as it is considered a holy place, people come from elsewhere with different languages and cultures. This can affect the proper execution of health processes and procedures.

5.5 Discussion of the findings and implications for theory and practice

The primary purpose of this section is to discuss the findings critically, derive theoretical and practical implications from them. In order to enhance readability and facilitate the understanding of the main results, this study has reviewed the main theories related to ICT adaptation, which included UTAUT, TAM, TRA, TPB, and the diffusion of innovation theory, as studied in Chapter Two. The four case studies from the public and private hospitals have also contributed to the implications for theory and practice. The aforementioned theories play an important role in understanding the determinants of users' behaviours and intentions because of the different moderators elucidated by the theories, including gender, age, and willingness to use.

5.5.1 Implications for Theory

In the general technology acceptance theory, several elements are seen as exerting a significant influence on the formation of adopting the technology. These elements have been explained in different ways, such as beliefs, attitudes, and behaviours (Ajzen & Fishbein, 1980). Regardless of semantic differences, the characteristics of the main variables taken into account by the TAM are attitude and subjective norm, which are proposed as determinants of behavioural intentions in the context of HIT-related EHRs (Ajzen & Fishbein, 1980). However, in this theory, attitude typically plays more of an essential role than subjective norm does (Ajzen & Fishbein, 1980). Similarly, the attitude was found to have the most influence on behaviour surrounding the use of the system in the four case studies, thus supporting this argument. Indeed, healthcare IT, social, and management aspects were among the issues surrounding attitude.

The development of this model is the result of analysis of the four case studies provided. The elements of adopting HIT are shown in the diagram below. There are two main variables: perceived ease of use and perceived usefulness, which in turn affect other variables. Most of the participants agreed that willingness to adopt technology is, to a degree, based on the user's education, gender, age, experiences, and resistance to change. In addition, the relationship between these different variables with perceived ease of use and perceived usefulness showed a positive relationship, including age and resistance to change variables. Most of the participants in this study mentioned that older users were not accepting of technology, while younger users accepted it. This example illustrates that the use of technology is affected by the variables elucidated in this study. The following diagram provides a suggested model of this study, based on the findings of the four cases studies.

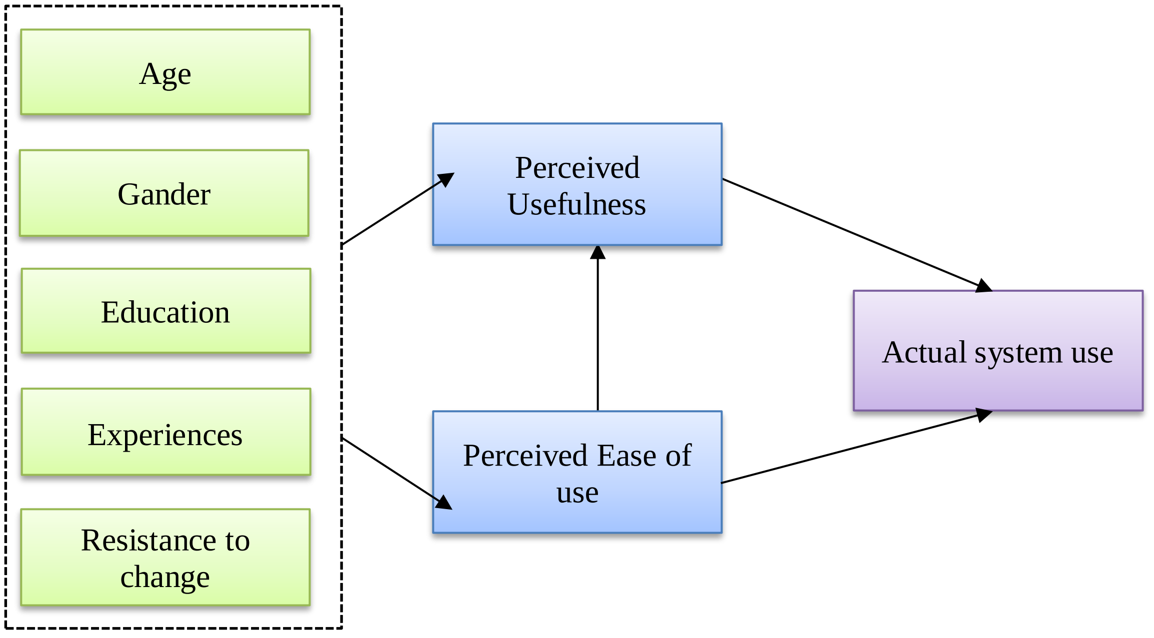


Figure 5-2: TAM suggested for this study

In the context of HIT-related EHRs, the subjective norm has been proven to be an essential effect (Ajzen & Fishbein, 1980). The results of this study indicate that subjective norm has a positive impact on user engagement with a HIT. As a result, it is possible, to sum up, that respondents are under attitudinal control rather than under normative control. This was clear when evaluating the adoption of the health record system, even if different factors may indirectly influence the attitudes observed.

In the diffusion of innovation, TAM, and TPB theories, the influence of technology on the individual's beliefs and behaviours has also been acknowledged (Rogers, 1983; Davis et al., 1989; Venkatesh and Davis, 2000; Ajzen, 1991). However, there have been criticisms of the extensive sets of characteristics that have been recommended by some researchers. The findings of this study show that the DOI model for the adoption of innovations was found to be a valuable tool for operational health factors. This allows for the development and refinement of the presently used adoption theory of EHRs. The diffusion of innovation theory, by Rogers, suggests that the adoption of technology is based on characteristics. This study developed a new model based on the various theories by viewing EMR adoption as a technological innovation and then examining the context for its adoption. The research herein addresses the gaps in this model and extends the existing DOI frameworks by incorporating the influences of contextual, industry-specific healthcare factors. However, there are four perceived attributes of EHRs that could influence health professionals' adoption and use of the systems. According to Rogers (2003), the four perceived main attributes are relative advantages, compatibility, complexity, and trialability.

The interview results showed that healthcare was improved by a decrease in cost and time expenditures, which appeared to be the main attribute attracting health professionals and patients to the adoption of HIT-related EHRs. However, most participants expressed their preference for using technology in healthcare. From their perspective, using EHRs was preferred to the use of paper. This was because EHRs provided them with immediate health data, unlike paper files. Similarly, EHRs reduced the risks of interference with medication. The participants indicated high personal advantages of the use of electronic health record systems.

Additionally, the EHRs were considered an opportunity for managers to follow up with patients' treatments. Furthermore, most of the participants agreed with the points raised in the literature reviewed: that using EHR integration provided patients with further value-adding services, such as access to their electronic healthcare records.

The participants interviewed also indicated varying points of view regarding compatibility. Some of the participants found that the main reason for clinical staff not to continue using electronic health records was compatibility with their paper files. It was discussed that using EMRs could duplicate work. There was a perceived risk of using EMRs, as the system can crash. Tradition and culture also appeared to play an essential role in hindering the adoption of EMRs/EHRs. There are limited studies that observed the effect of these factors on the adoption of consumer electronic health record innovations.

In case of EHRs being integrated between private and public healthcare organisations, the patients can only decide when and who can have access to the health data. This would improve health data privacy and confidentiality.

Despite the issues raised above, health professionals who continued to use both paper files and systems found EHRs easy to use. Some participants indicated that there was an increase in the workload, but that there were no usage difficulties because there was regular training. However, other participants disagreed, stating that the experience of using the system had been complicated and that they did not feel confident about their ability to use both systems and paper together for health records.

In this study, the health technologies used were limited to EHRs and PACs system. It was found that users continued to use both traditional paper-based methods and the electronic system for patient's files. There might be several explanations for this. For instance, users may not fully trust the system, as it sometimes crashed; there was also a privacy and confidentiality concern. According to Karahanna et al., trialability appears to be a less critical factor in determining an individual's decision to use an electronic system after individuals adopt the system continuously.

Information systems research on attitudes, subjective norms and perceived behaviour involves clarifying the differences in control of users dealing with EHRs in the four cases (Rogers, 1983; Davis et al., 1989; Venkatesh and Davis, 2000; Ajzen, 1991). When looking at attitudes, the results showed that there were apparent differences in attitudes towards the role of sharing health data online. Most of the participants who adopted health technology such as EMRs had a positive attitude, especially in private hospitals. Both participants from private and public hospitals believed that adopting HIT-related EHRs had benefits for patients, even when it involved an increased workload for the health professionals. However, attitudes to the adoption of EHRs among health professionals who had adopted it but did not believe in using it varied.

Overall, they did not see the benefits for users or patients and considered EHRs problematic. They preferred using paper files because they considered them more confidential; this attitude was especially prevalent in the private sector. Therefore, sharing health data electronically was a big concern, especially in private hospitals.

Subjective norms were indicated in the literature, and the user's adoption of EMRs appeared to be self-motivated. Health professionals who used electronic files during treatments were the most affected by, and most likely to be influenced by, others. Furthermore, the differences in perceived behavioural control reflected the users' differences in technology skills.

In summary, the results related to attitude towards the behaviour (AB) leave open the possibility that participants might have demonstrated attitudes inconsistent with their expressed perceived behavioural control (PBC), subjective norm (SN), and behavioural intentions (BI). This is due to either the nature of the EHRs themselves or the issue of social desirability bias. This finding was also supported by the archival information, which indicates that a large number of employees consider EHRs to be significant, even essential, in the reduction of health risks and costs. Additionally, perceived behavioural control is derived from beliefs about the presence of factors that may facilitate or impede the performance of the behaviour (subscription). A subjective norm is derived from beliefs about the normative expectations of others (Ajzen *et al.*, 2001).

This research has also applied the UTAUT model based on the findings of the public hospitals. The results indicate that the main factors influencing the adoption of technology are performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). These acts were significantly different to users' behavioural intention.

Performance expectancy (PE) is an extremely important factor influencing the adoption of EMRs in both types of hospital. In this study, PE is seen as the degree to which users believe that using EMRs can help to facilitate communication with patients regarding the benefits. These benefits include saving time and cost, improving the quality of health services, and improving governmental spending. The findings from both cases highlighted positive performance expectancy. The research results support that PE positively predicts behavioural intention to use EMRs services. The effect of PE on BI was significant, strong, and reflects the anticipated benefits of the use of EMRs in both hospitals. The public's performance expectations for EMR services might be improved by focusing on the usefulness of EMRs and the availability of such modern technology channels. In other words, if the advantages and benefits of using EMRs were demonstrated and promoted to public patients, as well as to all operations and management staff, the acceptance and use of EMRs would most likely increase in both types of hospital.

The effort expectancy (EE) variable in this study was explained as the degree of ease associated with the use of health information technology in public hospitals. It was measured by the perception of ease of learning, use of these systems, and how much effort could be spent using them. It is important to mention that the link between EE and BI has benefits for users.

There is a positive link between these two, which confirms that users are likely to adopt an easy-to-use system that demands little effort and takes less time to accomplish tasks than old methods. Furthermore, an important influence of the EE, which can be improved by providing simple EMR services, improves the quality of service by using simple and easily understood words and phrases, providing web-based assistance tools, and making clear the procedures and instructions for all services.

The social influence (SI) was explained as the extent to which an individual perceives others' opinions of importance when planning to use health information technology. It was measured by the perception of how social communication affected users' intentions to use EMR services. The main study results revealed a significant effect of SI on BI when it came to using EMRs. Thus, this one cultural impact is to adopt the technology, which is illustrated across several studies. Additionally, social influence (SI) affected users in both cases when it came to their willingness to adopt EMRs, in terms of their confidence, ability, and self-esteem when using the electronic system. Furthermore, this result indicates that EMR services are perceived as individual issues. This corresponds to findings by Venkatesh *et al.* (2003), who stated that the usage of a system depends on the individual user's beliefs, rather than on others' opinions or advice.

Overall, the interview findings suggest that a high level of relative advantages and low level of complexity are essential factors that encourage users to adopt EHR innovation. However, EHR integration is still in the initial knowledge stage of the innovation-decision process, and only the 'innovators' among both the IT and clinical staff adopt and continuously use this innovation. It seems from the case studies that this only happens if the top manager encourages them.

In this study, facilitating condition (FC) refers to the availability of IT and organisational resources, which can be used to support the use of EMRs. The study results showed that FC had a direct and significant impact on user behaviour in both cases. This result supports the idea of a direct link between FC and usage behaviour. It has been shown here that it is important to improve FC in terms of both human resources and electronic health to assist the adoption of EMRs.

5.5.2 Implications for Practice

These study findings have implications for practice in several areas. These insights can be leveraged by technology vendors, health organisations, and governments delivering IT health solutions, in particular, electronic health records (EHRs) and electronic medical records (EMRs) solutions. The suggestions for implications for practice are discussed across four areas: improving critical factors influencing the adoption of using the technology, including technical, social, and administrative factors, using adoption models, reducing barriers and risks, and evaluating the awareness of the positive impacts of adoption of innovation of EHRs/EMRs.

Awareness about the critical factors influencing the adoption of using the technology in health organisations: Attitude significantly affects the implementation of EMRs/EHRs. Users did not show a positive attitude to using the system because of the limited experiences in dealing with the system. Technical factors, such as low level of IT infrastructure, affected trust, which affects attitude to use. Miller *et al.* (2005) and Valdes *et al.* (2004) showed that changing attitude-behaviour towards positivity is essential in using EHRs/EMRs.

Additionally, EHRs/EMRs users with positive attitudes will encourage other users. This research suggested that awareness about the necessity of continuous training and improving IT standards and infrastructure were critical steps. Additionally, it is necessary to change the policy to encourage users to accept using the system.

The government can drive both private and public hospitals to adopt EHRs/EMRs. Having IT standards is essential to enhance the exchange of health data. Bates (2005), Brailer and Terasawa (2003), Hersh, (2004), and Sprague (2004) agreed that these standards are a direct influence on the adoption of EHRs. The results showed that IT standards and infrastructure not only affecting privacy but also trust. For example, the King Fahad hospital had the system crash during treatment; this made the users not trust the system. This research found that there was a low level of IT standards and infrastructure in all hospitals that influence adopting HIT-related to EHRs/EMRs.

Using adoption-evaluating model: Evaluation models such as (EMRAM) should ensure users' awareness of which stage of adopting the EMRs they are in. This will improve the progress of adopting EHRs/EMRs. HIMSS has created the engagement to help an organisation adopt EMRs to stages 6 and 7. Using IT suppliers, which is essential to successfully adopt the implementation of healthcare IT, requires HIMSS consultancy. Thus, the health organisation should improve care delivery through better use of technology with HIMSS analytics assessment and strategy services.

Reducing Barriers and Risks: Reducing the risk of losing health data and improving privacy and confidentiality are essential in all health organisations and are a necessity for the success of EHR integration between private and public hospitals. The risk is that health data may be subjected to illegal violations of privacy. However, research on how users share clinical and patient health data between different organisations can be built at national level with a secure online environment.

The present study provides proof that health information exchange can be done electronically and improve healthcare, with no effect on privacy and confidentiality. There are several elements to enhance the privacy and conditions, making it possible for health providers to manage. The most important of these elements is having a health information security standard. This research shows that the MoH does not clarify health information security privacy, which has to be the same in both private and public hospitals. This should include defining terms and conditions for all healthcare organisations. This policy can include a patient's right to permit to use his/her data, which can improve privacy and confidentiality in health information exchanges.

Awareness of the positive impacts of adoption of EHRs/EMRs on healthcare: The results of this study showed that adopting HIT-related EHRs/EMRs has been positive in practice on four levels. Firstly, EHRs improved the healthcare delivery process with better communication via the sharing of health information between private and public hospitals. Secondly, the effects of EHRs/EMRs on healthcare development are found in this study, including saving time and cost. The healthcare delivery process should be faster if the hospitals exchange the health data with each other. Thirdly, the health professionals who were working within both private and public hospitals indicated that by using EHRs/EMRs, they improved treatment decision-making and reduced medical errors.

As a result, it improved health quality and safety, with less time and cost. Fourthly, from the patient's point view, access to health data has to be secured and controlled by them during treatment. Patients who travel between private and public hospitals need to have the full health information data. This is essential to spread awareness to people, businesses, and governments about the importance of EHRs/EMRs, especially in non-developed countries. The key implications for practice are:

1. The Ministry of Health (MoH) should improve privacy and confidentiality by providing clear policy, terms, and conditions. This includes new policy, in particular, health information security standards.
2. IT standards and infrastructure not only create better trust and attitude but also reduce the user's perceived risk.
3. IT Security policies are relevant in reducing the user's perception of risks. This will encourage the organization to accept the technology and enable the exchange of health data. This research gives only the patients' right to permit health organisations to exchange his/her data on the day that the health services are done.
4. Users should be training regularly, as technology is always changing. This research recommended the need to have scheduled, regular training.
5. The current system users are dealing with both EMR system and paper files in case of system crashes or shutdowns. This significantly affects trust and attitude of using the EMRs in healthcare organisations.
6. MoH should develop national health plans and strategies to provide adequate financial and technical resources on an on-going basis.
7. Adopting basic standards for e-health services should be done. This includes improving IT standards and infrastructure.

8. Ensuring the availability of digital equipment in both primary health care centres and hospitals is essential. This will improve follow-up with patients and the quality of health data.
9. Providing IT human resources and IT staff with HIT experience is needed for managing e-health services. It also helps to inform people about the role and importance of ICT in the health field.

In summary, the findings indicate positive user points of view on the implications for the practice of using EHRs/EMRs. However, managers can reduce the current barriers affecting the use of the systems, which were highlighted in this research. The current use of EHRs is not integrated between different health organisation. This study shows that there is duplicated entering health data by users. This has reduced the usefulness and effectiveness of EHRs. It is important that people in health organizations accept this technology, because there are likely to be further improvements to health technology in the coming years. The future of ICT such as Telemedicine, IT cloud, and M-health will improve the healthcare process. More privacy techniques can also be used when exchanging health data, such as fingerprinted or ID sim cards. These would reduce privacy concerns and improve the exchange of health information.

In addition, it is important to change health information policy. For instance, the results show that having a clear policy would reduce any negative implications for practices. Managers should be driving the adoption of the current systems and minimising any errors or impacts. This will improve not only the use of the system but also the trust and attitudes of its users.

5.6 Conclusion

This chapter examined the critical factors influencing the use and integration of HIT-related EHRs among private and public hospitals in Saudi Arabia. The findings highlighted the importance of participants characteristics, perceptions, acknowledgements, and experiences in shaping their experience of EHR integration. Moreover, this study represents an initiation towards untangling the three themes that influence EHR integration by introducing a framework model determined by the qualitative results. The findings of the four case studies, based on the links observed in the literature, can be harnessed to refine several ICT theories, to better understand the process of adopting health technologies. Therefore, the findings of this research make some inductive and theoretical contributions to the current literature surrounding information technology, its adoption, and health informatics. The study also provides actionable insights for health and technology organisations interested in understanding the factors that influence EHRs and maximises the acceptance and adoption of health technologies. The final chapter will elaborate on the main findings of this thesis, highlighting the main contributions of the thesis as well as the limitations of the study and how these have been addressed.

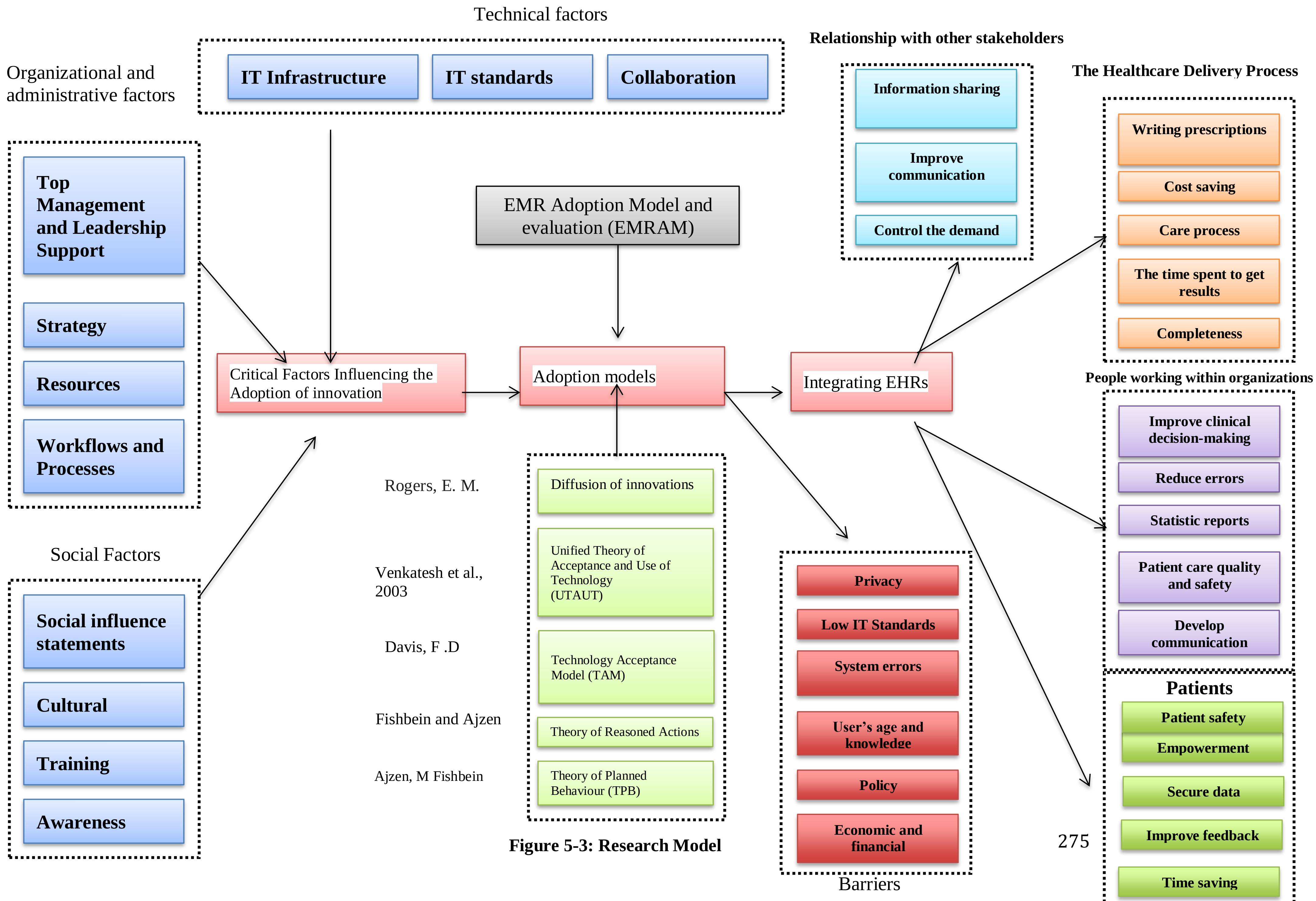


Figure 5-3: Research Model

Chapter six: Conclusion

6.1 Introduction

The primary purpose of this study was to contribute to an in-depth investigation into the influence of HIT-related EHRs, and the exchange of health data, in private and public hospitals. The study was followed by a demonstration in the form of four case studies, which included both private and public hospitals in Saudi Arabia.

The structure of the thesis is as follows: Chapter One justified the background of the study and provided an overview of the research objectives, research framework, and research contexts. Chapter Two provided a review of health information technology (HIT), including critical reviews on definitions, benefits, impacts, factors, risks, and barriers. This was followed by an in-depth critical review of existing literature pertaining to technology adoption, in order to identify gaps, as well as to determine the appropriate theories for this research. Chapter Three detailed the research philosophy, methodology, and data analysis steps involved in designing and examining the four case study methodologies. Chapter four provided the results of the interviews. Chapter five discussed the findings from these interviews in unison with the literature review, showing the similarities and differences between the literature and the results, to show the contributions of this research. This final chapter will now summarise this process, highlighting the main contributions of this study, followed by its limitations, recommendations, and pathways for future research.

6.2 The contribution and novelty of this research

This section presents the key inductive and theoretical contributions of this study. In Chapter Two, the current deficiencies in the literature relating to HIT adoption and integration were identified; these were also addressed in the proposed research framework model. These deficiencies are briefly reviewed in this section, in order to highlight how this study fills these gaps, adding significant scientific value to the understanding of HIT-related EHRs. To address these gaps in the literature, four experimental case studies were undertaken within Saudi healthcare organisations. The main purpose of this was to determine the status of the adoption of HIT-related EHRs within private and public health organisations, by investigating the critical factors, impacts, risks, and barriers influencing their adoption. This made it possible to derive several recommendations for enhancing the process of EHR integration and the exchange of health data. The following points epitomise the main contributions outlined in this study.

Contribution One: Introducing the framework model for the implementation of EHRs: in Chapter Two, a conceptual model for the implementation of HIT-related EHRs between private and public healthcare organisations was introduced. This model was reviewed using five theories related to the adoption of ICT. It was shown that the framework model was linked with a critical review of the factors, impacts, risks, and barriers surrounding the use of HIT-related EHRs. Thus, this presented the implementation process, which previous studies required.

Furthermore, the paradigms of the proposed model were synthesised from a comprehensive literature review, divided into several sections related to the adoption of health technology for EHR integration. The model proposed is new and no such model has ever been designed, thus providing a significant contribution to the field of HIT adoption and implementation.

Contribution Two: Understanding the critical factors that influence HIT-related EHR adoption: Before linking the contributions of impacts, barriers, and risks findings with factors usually explored after EHR implementation, it was essential to look at critical factors that influenced HIT. The critical factors that influenced EHR adoption in this study were divided into three main factors, as well as several sub-factors. These factors, collected and grouped by this research, were then combined with factors referred to and studied in previous research, to give an overall map of the main critical factors. Additionally, a comparison was drawn between the main factors present in private and public healthcare organisations, which then exposed some interesting differences.

Contribution Three: An investigation into the impacts, barriers, and risks of implementing EHRs and health data integration: Another essential contribution of this study was the clarification of the main areas involved in the implementation of EHRs. There were elements mentioned in the literature review, which had not previously been tested in terms of differences between different healthcare systems and/or organisations. As a result, an investigation into the impacts, barriers, and risks was conducted.

Contribution Four: Contribution to the scarce supply of case studies between private and public hospitals related to EHRs adoption: An interesting contribution of this thesis was that it was the first to look at the comparison between private and public health organisations in a Saudi context. Using a case study methodology can allow researchers to test real experiences related to EHRs, and investigate their ability to link private and public hospitals regarding the exchange of health data. Unfortunately, the current status of healthcare in Saudi Arabia means that private and public hospitals are unable to integrate successfully. For that matter, integration between different public hospitals is also difficult, as discussed in Chapter Five.

Contribution Five: Theoretical and empirical contribution: The theoretical contributions of this research related to the technical, social, and administration fields, based on reviews of the UTAUT, TAM, TRA, TPB, and diffusion of innovation theories. These theories have different stages of adoption, evaluation, and implementation. To date, none of these theories indicated any differences between the private and public sector when it came to using EHRs. Thus, this study has significantly contributed in that regard, as well as providing the essential elements which contribute to successful adoption.

Furthermore, the study has described how EHRs could be implemented, adopted, and evaluated within different healthcare organisations, as seen in Chapter Four. Moreover, the research perspective that marks this research project, from a methodological point of view, is one, which draws on critical theory.

This is in contrast to the dominant perspective in information and communication technology studies, which has commonly been characterised by the positivist tradition. In fact, most of these earlier studies were based on methods that neglected aspects of the cultural and social environment.

The recommendations below are also a further contribution of this thesis, to assist and support decision-making in both private and public sectors, especially in developing countries, to help improve health data exchange among healthcare providers.

6.3 Recommendations

This section offers advice to managers whose tasks include strategic planning and decision-making at governmental and business levels. The following recommendations are provided to improve healthcare in Saudi Arabia. The recommendations can also be lessons to any other countries. Therefore, these recommendations were established based on inductive and critical scientific evidence, through a review of current literature and the results of the four case studies. The following points constitute the main recommendations:

- ***Recommendation One:*** it is highly recommended that the decision makers have a strategic plan in place regarding health information management policy, in order to improve health privacy. There is a strong need for the Saudi government to establish a health information management plan at an early stage. It is suggested that to improve healthcare, a national health information network system is needed. However, this plan should involve several government agencies, such as the Saudi Arabian Ministry of Interior. Another agency that needs to be more involved is the Ministry of Health, which must push both private and public hospitals to implement a health information exchange.

Moreover, health data must be compliant with the privacy policy as designed by government agencies, which monitors the use of health information. The privacy legalisation allows hospitals to protect health information, but it must be followed at all times.

- ***Recommendation Two:*** it is essential to give administrative powers to all organisational levels, thus improving the flexibility of decision-making. To improve decision making regarding EHRs, a decentralisation process is recommended. The main factor delaying the implementation of EHR projects is the centralisations of the decision-making process. This is especially more prevalent in public hospitals, as shown in Chapter Four. For example, top managers in the MoH make the majority of financial decisions. Thus, it is necessary to change the management and organisational system to give more power and authority to all Saudi regions to be more independent when it comes to decision-making. Additionally, communication and collaboration are essential in order to engage and involve administrative and clinical staff in the development of EHR projects. Other factors at play include effective communication, collaboration, educational leadership, commitment, and training.
- ***Recommendation Three:*** governmental policies and standards need to be set for the adoption of health information systems. The policies and standards can be improved in alignment with the hospitals' vision, to facilitate the establishment of an interoperable IT infrastructure. Undoubtedly, healthcare organisations' policies and IT infrastructure standards should be updated to match health care needs. Furthermore, these policies and IT infrastructure standards should involve both health professionals and top management staff during the adoption process, to increase the probability of the system's adoption, success, and adherence.

It is also suggested that the hospital's infrastructure is redesigned to match the needs of the IT and network system, before proceeding to the adoption stage. Additionally, IT infrastructure standards should be the same across different hospitals, in order to ease integration. The Ministry of Health can establish the minimal policies and standards for IT infrastructure, and ensure both the private and public healthcare providers adhere to these too.

- ***Recommendation Four:*** to improve the reengineering process and workflow, when implementing HIT-related EHRs, it is recommended all processes and workflow procedures be reviewed by health professionals before the implementation process begins. It is highly recommended that IT and clinical staff collaborate to understand health processes, which would then allow IT designers to match the values and needs identified within the system. In addition, it is suggested to improve business process management skills. This will enable users to improve workflow by adopting IT in the healthcare sector.
- ***Recommendation Five:*** implementing the privatisation of government hospitals can improve the adoption process for EHR projects. Privatization is the concept used for all outstanding shares of a publicly traded company by private investors. Through privatisation, hospitals can develop a culture of cost analysis and rationalisation, to improve financial management, program budgeting, and accountability. Additionally, it will assess the efficiency of hospital management and the quality of services, including electronic management and leadership to improve health quality.

6.4 Limitations of the research

Limited academic research had previously been undertaken in exploring the adoption of EHRs and integration between private and public hospitals. Thus, from theoretical and methodological perspectives, there were several limitations to the research undertaken here.

1. There was confusion between the definitions of health information technology and health information systems. These two concepts, EHRs/EMRs, were explained, and they share many similarities and conflicts. However, this study sought to clarify these concepts, in the beginning, in order to avoid confusion. Additionally, there were limited resources comparing ICT theories from a qualitative standpoint. There were also limited up-to-date reports from governmental sources relating to the Saudi Arabian health care system. Furthermore, this study was time-consuming, involving the need to travel to Saudi Arabia to collect data. In addition, it was not possible to examine the adoption of EMRs through case studies, as Electronic Health Record integration has not yet been implemented between private and public hospitals in Saudi Arabia.
2. There was difficulty-accessing data concerning health organisations, due to confidentiality and privacy reasons. The time-consuming tasks involved in this research included the collection, processing, and analysis of the data for the four case studies, particularly as the organisations in question had different EHR systems. Therefore, for confidentiality reasons, gaining access to information was not easy, even after getting ethical approval from the MoH. Additionally, some participants preferred not to clarify personal data, for personal reasons, while some clinical staff were not available when the data collection took place, as they were attending meetings, treating patients, or performing surgery.

3. This research has shown limitation to implement the health information integration between private and public hospitals. However, this study gives steps for managers to adopt EHRs integration within reducing the limitation. Additionally, this study has investigated a list of difficulty, impacts, and barriers, and factors were facing adopted EHRs, and it was essential to identify them to reducing any difficulty of implementing EHRs integration.

6.5 Directions for future research

This study has established a starting point for understanding the application of health information technology, by developing a model of the critical factors, impacts, risks, and barriers, which influence the adoption of HIT-related EHRs. The overall findings, as well as the limitations, of this research, provide a guide for further research in different areas. These areas include:

- The comparison studies between Saudi Arabia and other countries regarding the use of HIT-related EHRs. The linking of private and public hospitals for the exchange of EHRs is also recommended for future study.
- The impact of privatisation on public hospitals. There is a national plan to make all public hospitals in Saudi Arabia privatised as part of the government's national vision 2030 plan. However, not enough research has been done regarding the impact of privatisation on public hospitals, particularly in Saudi Arabia. This study would be beneficial for decision-making at top management levels, in particular, within the Saudi Arabian Ministry of Health.

- In the area of integrating insurance companies with private and public hospitals using EHR applications. For example, the use of electronic health records would improve communication with insurance companies, allowing insurance companies to reach decisions surrounding healthcare cover more quickly. However, when it comes to privacy concerns, not enough studies have investigated the risks and barriers affecting the electronic exchange of health data between insurance companies, private, and public hospitals.
- From a methodological point view, future research could use a systematic review. For statistical studies, this technique is suggested in order to develop and test a list of hypotheses.
- Using quantitative or mixed methods. One suggestion for future research would be a study that compares the USA and the UK regarding the use of eHealth technology, such as mHealth systems. This study could be done through a quantitative survey and can look at the patients travelling between these countries and examine how they can share their health information.

6.6 Conclusion

Notwithstanding the limitations presented in this chapter, this study contributes significantly to the areas of health information technology, health informatics management, and HIT adoption. Several relationships were established between the findings extracted from the four case studies, and the qualitative data examined, thus providing evidence to support this data. This was achieved through an exploration of a HIT, EHRs, and the factors, risks, and impacts of these on the Saudi Arabian healthcare system. The study explores the theories of Diffusion Innovation, UTAUT, TAM, TRA and TPB, to provide a more comprehensive understanding of the impact of health information technology on healthcare. Finally, this study has designed an adoption model that takes into consideration the critical factors, impacts, risks, and barriers related to the adoption of HIT-related EHRs. This model represents a strong starting point for the untangling of the labyrinth that is information technology construction in healthcare. This model can also be reviewed and developed further in future research. Health organizations, technology vendors, and government bodies charged with implementing new health technologies can significantly benefit from the insights in this study.

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Appendix A: Ethical Approval DCU

Ollscoil Chathair Bhaile Átha Cliath
Dublin City University

DCU

Ahmad Aljohani
DCU Business School

8th July 2016

REC Reference:	**DCUREC/2016/061**
Proposal Title:	**An investigation into the impacts of HIT - A comparative case study of EMR's in Saudi Arabian private and public hospitals**
Applicant(s):	**Ahmad Aljohani, Dr Paul Davis**

Dear Ahmad,

Further to ethical review, the DCU Research Ethics Committee approves this research proposal.

Materials used to recruit participants should note that ethical approval for this project has been obtained from the Dublin City University Research Ethics Committee.

Should substantial modifications to the research protocol be required at a later stage, a further amendment submission should be made to the REC.

Yours sincerely,

Dónal O'Mathúna

Dr Dónal O'Mathúna
Chairperson
DCU Research Ethics Committee

DCU
Research & Innovation

Taighde & Nuálaíocht Tacaíocht
Ollscoil Chathair Bhaile Átha Cliath,
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Appendix B: Ethical Approval MoH

Kingdom of Saudi Arabia
Ministry of Health
General Directorate of Health Affairs
Al-Madinah Al-Monawrah Province
Training & scholarship Administration

المملكة العربية السعودية
وزارة الصحة
المديرية العامة للشئون الصحية بالمدينة المنورة
إدارة التخطيط والتدريب
300 / 275

وزارة الصحة
Ministry of Health

إدارة التدريب والابتعاث

IRB Approval form	date:25 january 2016

To: Ahmad Aljohani – PhD

This is to certify that Ethical Research At General Director Affairs Committee Al Madina has reviewed all the submitted updated and amended Documents from the ethical point of view and has approved your study titled:

The Impact of HIT related EMR on healthcare systems in Saudi Arabian private and public Hospitals

The committee is fully compliant with the conditions and principles of good clinical practice. The committee is constituted in accordance with the WHO and ICH-GCP guidelines and works according to written Standard operating Procedures.

Below are the list of IRB members that reviewed and approved the above mentioned documents, Kindly to know that only those IRB members who are independent of the investigator and the sponsor vote/ provide opinion on Trial related matter:

1-Dr.Abdulqader Al Taeeb	Member of Community
2-Ph. Thoraya Al Zahrany	Head Of Training And Scholarship Adminstration.
3-Dr.Sabah Halabi	Member, Consultant Pediatric
4-Dr.Atif Albouq	Member, Consultant Pediatric
5-Dr.Abdullah Al Shenqiti	Member, Consultant Rehabitation
6-Dr.Manal Majoun	Member, Specialist Obstetrics&Gynecology.
7-Dr. Hussain Kalu	Member, Adult Cardiologist
8-Dr.Osman Mansor	Member, Consultant psychiatric
9- Dr.Amani Mohammed Mahrus	Member, consultant Family Physican

The REC recommended granting permission of approval to conduct the project along the following terms:

1. If there are any further amendments, they must be approved prior to implementation unless they are intended to reduce risk.
2. Monitoring: the project may be subject to an audit or any other form of monitoring by the REC.
3. All unanticipated or serious adverse events must be reported to the REC within 5 days or according to the protocol
4. Inform the IRB prior to making prospective changes to the study procedure
5. Upon the study completion, The PI is expected to submit a final report at the end of the study

Please note that this approval is valid for one year commencing from the date of this letter.

Head of IRB committee deputy

Ph.Thoraya Al Zahrany

الرقم : 46/	التاريخ : 16/ ت 1435/هـ	/ المشفوعات :

هاتف 8467550 فاكس تحويلة 100 البريد الإلكتروني: Madinah.search@gmail.com

Appendix C: Informed Consent Form

DUBLIN CITY UNIVERSITY
Informed Consent Form

PROJECT TITLE: An investigation into the impacts of HIT- A comparative case study of EMRs in Saudi Arabian private and public Hospitals

SCHOOL/UNIT: DCUBS/Management

Investigator Details:
Ahmad Aljohani
Q244
DCUBS
Glasnevin
Dublin 11

Mobile:0852850427
APPLICANT EMAIL: ahmad.aljohani2@mail.dcu.ie

The main objective of this study is to identify the key issues in the development and implementation of Health Information Technologies (HIT's) and to evaluate how the adoption of Electronic Medical Records (EMR's) influence the delivery of healthcare services in private and public hospitals. This will involve the analysis of how these systems affect the organization and operations through interviews of the systems main end users. An additional objective will be to explore the initiatives undertaken by the Ministry of Health (MOH) for EMRs implementation and to outline its achievements to date in the adoption of EMRs.

This research forms the introduction to a work program being developed for the objective analysis of the impact of HIT. The initial research work is focused on the development of metrics that can be used to assess the impact in terms of both economic and social measures of technology within a health care environment. This initial research focuses on the development of HIT and in particular focusing on a context within one country, that of the Kingdom of Saudi Arabia.

The initial work objectives are:

1. To conduct a comprehensive research with review related to EMRs and Saudi healthcare systems.
2. To review the existing adoption models and consider how these models could be extended or modified to reflect the adoption process of HIT related EMRs at the decision-making stage.
3. To develop a theoretical model, based on the models identified in Objective 2, of the critical factors influencing the adoption of HIT - related EMRs in healthcare organizations at the decision-making stage.
4. To identify the current EMRs adopted in Saudi healthcare organizations.
5. To assess how the current EMRs in Saudi healthcare organizations are adopted and are being supported.
6. To examine the roles of the current EMRs adopted in Saudi healthcare organizations well as any issues.

III. Confirmation of particular requirements as highlighted in the Plain Language Statement

Participant – please complete the following (Circle Yes or No for each question)	
I have read the Plain Language Statement (or had it read to me)	*Yes/No*
I understand the information provided	*Yes/No*
I have had an opportunity to ask questions and discuss this study	*Yes/No*
I have received satisfactory answers to all my questions	*Yes/No*
I am aware that my interview will be audiotaped	*Yes/No*

IV. Confirmation that involvement in the Research Study is voluntary

I may withdraw from the Research Study at any point.

V. Advice as to arrangements to be made to protect confidentiality of data, including that confidentiality of information provided is subject to legal limitations

Confidentiality is an important issue during data collection. Participant's identity, or other personal information, will not be revealed or published without permission. For the interviews, as numbers are small there may be a slight risk that individuals may be linked to the data, however all responses interview will have a code attached to them, with names removed and will be dealt with on a strictly confidential basis. All raw data will only be available to the research team. In accordance with DCU policy all data will be kept on-site in DCU in a locked secure area.

VI. Any other relevant information

The sample size for the study is five interviews from each hospitals and as a result of the relatively small sample size there may be implications for the interviewee's anonymity.

VII. Signature:

I have read and understood the information in this form. My questions and concerns have been answered by the researchers, and I have a copy of this consent form. Therefore, I consent to take part in this research project

Participants Signature: ______________________________

Name in Block Capitals: ______________________________

Witness: ______________________________

Date: ______________________________

Appendix D: Plain Language Statement

DUBLIN CITY UNIVERSITY
Plain Language Statement

PROJECT TITLE: An investigation into the impacts of HIT- A comparative case study of EMRs in Saudi Arabian private and public Hospitals

SCHOOL/UNIT: DCUBS/Management

Investigator Details:
Ahmad Aljohani
Q244
DCUBS
Glasnevin
Dublin 11

Mobile:0852850427
APPLICANT EMAIL: ahmad.aljohani2@mail.dcu.ie

Introduction

It is proposed that this research will explore the using of Electronic Medical Record (EMR) in Saudi Arabian private and public Hospitals. The researcher has noticed that Healthcare in Saudi Arabia, in particular, has been significantly improving in recent times with difficulty of using eHealth technologies. This has been accompanied by advancements within the field of Information and Technology (IT), more specifically Electronic Medical Record Systems (EMRs). The application of EMRs has been a necessity for hospitals in order to achieve objectives such as enhancing the quality of healthcare provided and reducing the time and the cost of healthcare delivery.

The purpose of this research is to address the internally and externally impacts of EMRs have on the healthcare industry. The impacts can be cost, quality efficiency, process, and performance. The second purpose of this research is to investigate the key issues and challenges in the implementation of EMRs and How are EMR systems adopted by different health organizations. Furthermore, the research will explore the critical factors influencing the adoption of EMRs in healthcare organizations EMRs in Saudi Arabia for both public and private hospitals.

Involvement in the Research Study:

The research approach adopted requires the researcher to interview different level of management in both private and public hospitals in Saudi Arabia. These interviews are designed to help the researcher to fully understand the gap between private and public hospitals with respect to the adoption of EMRs. It is important to mention that the researcher will not seek to any personal details of participants. Moreover, the researcher will not be collecting any sensitive investment. The interviews will be between 30 min to 45 min in duration with the permission of interviewee, recorded (audio only). After the interview, the researcher for clarifications may contact the participants.

Participation in the interview process entails no personal or professional risks. Individual contributors will not be identified and all recordings and resultant transcripts will be treated as confidential records within the limits of the law and will not be disclosed to any third party without the written permission of the interviewee. Records will be stored electronically on a local (sit based) server and will be password-protected. Where trusted by interviewee the interview recordings will be deleted within five years of the study being completed.

Participation in this research is voluntary and participants may withdraw from it at any stage of the process. That said an interviewee who fully participate would receive a copy of the completed study before publication. Additionally, they will receive a copy of any subsequent relevant papers developed by the researcher.

Discomfort/ Risks:
There are **no** specific risks associated with this study.

III. Confirmation of particular requirements as highlighted in the Plain Language Statement

Participant – please complete the following (Circle Yes or No for each question)

I have read the Plain Language Statement (or had it read to me)	*Yes/No*
I understand the information provided	*Yes/No*
I have had an opportunity to ask questions and discuss this study	*Yes/No*
I have received satisfactory answers to all my questions	*Yes/No*
I am aware that my interview will be audiotaped	*Yes/No*

IV. Confirmation that involvement in the Research Study is voluntary

I may withdraw from the Research Study at any point.

V. Advice as to arrangements to be made to protect confidentiality of data, including that confidentiality of information provided is subject to legal limitations

Confidentiality is an important issue during data collection. Participant's identity, or other personal information, will not be revealed or published without permission. For the interviews, as numbers are small there may be a slight risk that individuals may be linked to the data, however all responses interview will have a code attached to them, with names removed and will be dealt with on a strictly confidential basis. All raw data will only be available to the research team. In accordance with DCU policy all data will be kept on-site in DCU in a locked secure area.

VI. Any other relevant information

The sample size for the study is five interviews from each hospitals and as a result of the relatively small sample size there may be implications for the interviewee's anonymity.

VII. Signature:

I have read and understood the information in this form. My questions and concerns have been answered by the researchers, and I have a copy of this consent form. Therefore, I consent to take part in this research project

Participants Signature: ______________________________

Name in Block Capitals: ______________________________

Witness: ______________________________

Date: ______________________________

Appendix E: Interview Questions Agenda

1. **Thematic "the critical factors influencing the adoption of HIT related EMRs in healthcare organizations"**

Interview questions	**References linking to the Lit review**
What are your rules in the adoption EMRs process?	Fichman and Kemerer (1999) Rogers (2003) (Greenhalgh *et al.*, 2005) (Omachonu and Einspruch, 2010)
Are there a specific department concerning health information technology issues? If yes, what rules are imposed by this department regarding the purchasing, adoption and implementation of IT applications?	Rogers (2003) (Dobbins *et al.*, 2002)
In your opinion, what other organisational factors are likely to influence the adoption process of HIT related EMR in the organisation	(Omachonu and Einspruch, 2010). Rogers (2003)
What are the main costs (e.g. hardware, software, development, maintenance, consultancy, employees' training, business process re-engineering, organizational restructuring, standard body membership … etc) associated with the adoption of EMR & HIT	(Ciampa and Revels, 2013). Behkami and Daim (2012) Aldosari (2014) (Odukoya and Chui, 2013)
In your opinion, how can healthcare organisations predict and respond to these aspects effectively and efficiently before the adoption EMR & HIT? How is your HIT infrastructure organised?	Ciampa and Revels, 2013, p.4 (Odukoya and Chui, 2013) Tierney *et al.* (1993) Chaudhry *et al.* (2006)

2. Thematic "the key issues, impacts and challenges in the implementation of EMRs"

Interview questions	References linking to the Lit review
What is the hospital policy with regard to the purchasing, adoption and implementation of IT applications such as EMR?	Dobbins, M., Ciliska, D., Cockerill, R., Barnsley, J. and Dicenso, A. 2002
How do the organization deal with the key issues and challenges in the implementation of EMRs?	Seligman, 2006 Henderson *et al.*, 2012 Rogers 2003 Pizziferri, L., Kittler, A.F., Volk, L.A., Honour, M.M., Gupta, S., Wang, S., Wang, T., Lippincott, M., Li, Q. and Bates, D.W. 2005
What are the key challenges in the implementation of EMRs?	Wang *et al.* (2003) Ciampa and Revels (2013) enderson, C., Dancy, M. and Niewiadomska-Bugaj, M. 2012. Kautz, K. and Åby Larsen, E. 2000 Mustonen-Ollila, E. and Lyytinen, K. 2003
What are the key issues in the implementation of EMRs?	(Sahin, 2006) Rogers 2003
What is the overall cost of the adoption and implementation of EMR & HIT?	Wang *et al.* (2003) Ciampa and Revels (2013) enderson, C., Dancy, M. and Niewiadomska-Bugaj, M. 2012. Kautz, K. and Åby Larsen, E. 2000 Mustonen-Ollila, E. and Lyytinen, K. 2003

3. Thematic “EMR systems adopted by different healthcare organizations and what are their main internal and external impacts”

Interview questions	References linking to the Lit review
Have any activities (e.g. promotion and awareness-raising, pilots and demonstrations, sponsorship, information and technical support, resource allocation, vendor support, consultant support and government support … etc) been carried out by the government and/or other parties to encourage and support the uptake of HIT related EMR? Please explain.	Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica, W., Roth, E., Morton, S.C. and Shekelle, P.G. 2006.
Have you carried out any consultations with regard to HIT related EMR? If yes, what impact did the consultants have on the adoption of EMR?	Suginaka, H., Okamoto, K., Hirano, Y., Fukumot, Y., Morikawa, M., Oode, Y., Sumi, Y., Inoue, Y., Matsuda, S. and Tanaka, H. 2014.
How does participation in EMR activities, either at a national or international level, impact on the adoption of the EMR? Please explain	Ciampa and Revels, 2013 and Tierney *et al.* (1993)
What are impact of EMR & HIT on Saudi patients related to the cultural, services and marketing?	Aksoy, P. and Denardis, L. 2007 Hasanain, R., Vallmuur, K. and Clark, M. 2014
What are the impacts of the adoption of HIT related EMR? Are there impacts on patient’s services, human resources, time, budget, leaderships, planning etc.?	Tierney *et al.* (1993) Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica, W., Roth, E., Morton, S.C. and Shekelle, P.G. 2006.

Appendix F: An example of the coding process

The interview number 1 29 min
OHAD hospital
Head of the E- health department in Ohad hospital with experience 7 years

Can you explain the core system that you have?

the Core System

The main system we have is OASIS that develops with Balsam the main vendor for the system; we actually have had some difficulty, which impacts us on implementing the system, The system is a complete system with all functions; however, there is the issue with users. Also, there are some issues with the system but we contact with the vendor to support and fix the problems. The system is linked with x-ray and pharmacy now we try to link with laboratory.

the Changing implementing

Is the system able to secure the patents data patient data?

Positives impacts.

technical positive

The system is totally secure with user ID all users have to sign the privacy form any problem can happen in the OPD or the emergency we able us to find the user easy. Following users, there is no difficulty or, comment that come from using the system. No Changes

There is any process that you follow to implement the system?

First, we have the model for every functional for example we have to implement the system on the OPD which start first with the prescription order model. We start with the users who work in the OPD and explain with them the process and how to use that then we implement the system.

Social factors

The training and education for the clinical staff took about 1 month able us to teach and fix the challenges; we started the system for 2 weeks after training after that we implement the system.

How about the infrastructure is it enough which able you to implement the system?

examples of IT resources

technical factors.

In general, we have a good infrastructure such as new servers and networking there is only one server that we have the problem which shut down once for 2 years, the infrastructure of the Ohad hospital is very old but we have updated that building which able us to implement the system we still use the paperwork as the system that we have not fully implemented the main issues is the users who not able to accept the system. So, they still use the papers work.

Risks

IT infrastructure Challenges

Issues Social factors

The main important is the patents data that, not loss or shared with any other users. Some issues regarding users are attitude some of the users do not accept the technology so the looking for any problem in the system to stop use it. Some users are happy about the system and behavior well and using the systems in a professional way. Users dealing with System

Risk and impacts

Social

Especially, the problem rises in the users of reception in the emergency department. We have a low number of employees in the E-health department is low. We have on call after main working hours shift. The main problem is the users which looking for any small problem in the system or hardware.

with issues users

management issues and impacts.

Social factors impacts

We have the problem with the old age consultant who is not adjusting it with the system. The take long time with patients which writing the prescription.

There is any problem with security issues?

no problem with security

There is no problem with this

There is any another system that you use

There is the archiving system for old files by using the scanner so there is the image for the file in the system.

What is your main motivation to use HIT-related to EMRs?

impacts. management factor.

Positive impacts management factors.

The way what the hospitals use by paper will be changing by the time to be less paper use. For ministry of health here in Saudi Arabia point of view using, using the system especially for ordering medicine by online as well as linking all data such as cost and demand, it will help Ministry of health to control the budget easily. For example, if the hospital gives you online 1 medication bar by the system will not able the pharmacy gives you any later on without E-prescription from the doctor. However, by using paper will be hard to follow stock as well as managing above ordering the medicine tapes. Using the system EMRs is better than the paper file because it will able to save time as well as reduce the risk of damaging the file. Using system will able us to have accurate statistics fast and efficient.

management factor.

Disadvant and Advantage.

impact.

Are there any steps to implement HIT?

Yes, we have. In general, we start by establishing the system then checking lastly training the users.

the mackel to adapt technology

What are the main issues and challenging that you have related to the system?

technical issues. negative impacts.

The main issue that in the systems, we have the old vision of the system, which causes some issues. For example, in the pharmacy, the doctor orders some medicine, which is old or conflicting with other medicine.

What are the main barriers that you have?

management effect.

The cost of the new vision of the system is very high as well as the implementing process will take long time.

What are risks do you have?

risk of no accesses.

The main risk that is a load of users with less network system that we have. We try to add more switches but the hospital is very old.

What are the external or internal of impacts of HIT on the Ohad hospital?

Social factor Cultural impacts.

technical factor

I think using an online system by the website to make an appointment or adding data to the online system. The behavior of using technology is about the cultural that accept technology and use will able to adjust technology.

Some internal impact is bad infrastructure because of the loud we have. Also, the old users such as old consulted from clinical staff who not use to the use of the IT.

integrating EHR

Positive impact

management and Social impact

Communication

Using the one electronic file that can use for both and public hospital will have the positive impact on the society. There is difficulty rise in the mainstay of health which not implementing one system that can be linking with a deferent region. Some patients travel a long distance to get the medication. But I think be using one system will able us to contact with another hospital easy anytime anywhere. I think should to implement that from beginning not now. But I think it is important to make system consolidation.

Appendix G: Conducting, analysing and coding

	Hospitals	Participants	Thematic 2 The impacts of HIT-related EMRs on health care	Code	Note
2	Ohud Hospital case study	P1/OH. Head of the E-health department.	To have a positive impact on patents.	positive impact	There is postive point veiw
3			Saving the patient data is more effective and efficient.	effective and efficient.	
4			Using OASIS is helpful for statistic point view.	helpful for statistic	
5			Making statistical report is easy to get via the system to help external side to make the decision.	statistical report	
6			To control the budget easily	control the budget	
7			To save time as well as reduce the risk of damaging the file.	reduce the risk of damaging	
8			Using system will able us to have accurate statistics fast and efficient	accurate statistics	
9			Using the system able to reduce using paper	reduce using paper	
10			The OASIS has high privacy, which allows the doctors only to get access to add details to the patient file	to get access	
11		P2/OH. IT specialist	No impact on privacy in some cases	No impact on privacy	There is ostive point veiw in the privacy
12			To share the data outside of the hospital electronically	To share the data outside	
13			The main impact is the demand of patients, especially on eye clinic	impact is the demand	
14		P3/OH. IT specialist	Improve education by teaching and training the users.	education by teaching and training t	
15		P4/OH. Administration staff	The paper file is more secure than electronic.	The paper file is more secure	Nigative point view
16			The users in the system able to change and adding data any time which makes the less secure and privacy	less secure and privacy	
17			Using HIT is highly a positive and recommended to implementing to develop culture,	highly a positive and recommended	
18			To catalogue and controlling the disease and make statistics report fast and easy.	statistics report	
19			Using system will control the cost of the hospital fast and easy.	control the cost	
20			To make the easy decision in the future.	easy decision	
21			To help plans the need for human resource in the future.	help plans	
22		P5/OH. Clinical staff	it has a positive impact especially on saving time.	saving time	Follow up postive point view
23			It is also making information very easy to find.	information to get	
24			The system helps to follow up the patients' health history if the information if lose it.	follow up the patients	
25			The system contributes to follow up the patients' health history in case the information loses it.	follow up the health	
26			The disadvantage is when writing the quantity of medicine and sometimes notice that the system shut down.	the system shut down.	
27			It has more advantage than the disadvantage.	more advantage than the disadvantage.	

Appendix H: Author's Publication

An investigation into the adoption of Health Information Technology (HIT): A case study in Saudi Arabian Public Hospitals

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Abstract**-- The adoption of health information technology is seen worldwide as one method to reduce the widening health care demand and supply gap. The purpose of this paper was to identify the current state of the health information technology in public hospitals in Saudi Arabia. The goal was to analyze the implementation outcomes from Electronic Medical Records (EMRs) by using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. A comprehensive literature review of peer-reviewed articles was undertaken to identify the current state of knowledge related to the implementation of health information technology in Saudi Arabia and the wider medical fields. This paper examines the extent of HIT on EMRs adoption in Saudi public hospitals by using a case study approach. The study is based on two case studies Ohud hospital and King Fahad hospital in Madinah, Saudi Arabia. In-depth interviews were used with health professionals and administration staffs. The secondary date was collected from annual reports; workshops reports, reviews, and websites. The primary results were introduced under four factors which are Performance Expectancy (PE), Effort Expectancy (EE), the social influence (SI) and Facilitating Condition (FC). The main result, there is entirely agreements between both cases study there was not model to adopt the EMRs.**

Keywords**--Health Information Technology (HIT), Unified Theory of Acceptance and Use of Technology (UTAUT), Electronic Medical Record system (EMRs), Adoption, health information systems (HIS).**

I. Introduction

Based on a review of the literature on diffusion innovation and social system it has been shown that, the target of using e-Health technologies is dependent on adoption by a critical mass so that the rate of adoption becomes self-sustaining and creates further growth. However, the implementation of such EMRs as core systems in Saudi Arabia's healthcare for both private and public hospitals has been improving in recent times. This has been accompanied by advancements in the field of e-Health technologies, including health information and technology (HIT) and health information systems (HIS). The application of EMRs has been a necessity for hospitals to achieve objectives, such as enhancing the quality of healthcare provided and reducing the time and cost of healthcare delivery. Additionally, it is widely acknowledged that EMRs would provide a transformative benefit to the Saudi health system, resulting in improved patient care, greater transparency, less paper, and improved resource efficiency and decision making. UTAUT model used to test and analyzing the adoption of using the core system. The main reason behind using the UTAUT model is because the only model that a reviewed and combined of the constructs of eight models that earlier research had applied to explain information systems usage behavior which are (theory of reasoned action, technology acceptance model, theory of planned behavior, a combined theory of planned behavior/technology acceptance model, model of personal computer use, diffusion of innovations theory, motivational model, as well as social cognitive theory).

The advantage of using the UTAUT model is for analyzing the impacts of adoption EMRs on the healthcare sector. The level of adoption of EMR's in a developing country, such as Saudi Arabia, will be investigated through covering the theory of UTAUT model. Additionally, this research focuses on several areas, including EMRs and their impacts on cost, quality, efficiency, process, and performance. Interviews have been conducted to examine the cases of using EMRs in Saudi Arabia for both public and private hospitals.

II. Theoretical background

A. Health Information Technology (HIT) and Electronic Medical Record system (EMRs)

Health Information Technology (HIT) has been defined in many ways. It has been described as a method of managing health information, as a mechanism to improve patient care, or as a process that enables patient care coordination. According to

Ciampa and Revels [1], HIT is defined as "the use of hardware and software in an effort to manage and manipulate health data and information". Davis and Lacour defined HIT as "the specialty in the field of health information management that focuses on the day-to-day activities of health information management that support collection, storage, retrieval, and reporting of health information". EMRs are a computerized HIT/HIS which provide patient records which include detailed encounter information such as encounter summaries, patient demographics, medical history, allergies, lab test histories, and intolerances. Additionally, EMRs supports order entry results, result management, and decision support. In some cases, EMRs also can be integrated with software, which can schedule appointments, set up billing tasks, and making reports.

B. Theories behind Implementation and adoption health technologies.

The table shows 20 most cited previous publications most during 1999-2016 (with over 49,320 citations in total). In addition, the most influential theories and models are depicted, as these are the ones, which are used in the research on EMRs adoption.

TABLE I
SUMMARIES THE MAIN THEORIES BEHIND ADOPTION TECHNOLOGY

Theory	Author(s), year
1. Technology Acceptance Model (TAM)	
TAM	Davis, 1989 [2, 3]
TRA and TAM (comparison)	Davis et al., 1989
TAM, TPB, and the Decomposed Theory of Planned Behaviour (comparison)	Taylor and Todd, 1995 [4]
Extension called TAM2	Venkatesh and Davis, 2000 [5]
TAM and TPB (comparison)	Mathieson, 1991[6]
TAM (replication)	TAM (replication)
2. Theory of Reasoned Actions (TRA)	
TRA and TAM (comparison)	Davis et al., 1989
TRA	Fishbein and Ajzen, 1975[7]
TRA and DOI (combination)	Karahanna et al., 1999[8]
TRA	Ajzen and Fishbein, 1980 [9]
3. Diffusion of Innovations (DOI)	
DOI	Rogers, 1983 (different editions) [10]
DOI	Moore and Benbasat, 1991 [11]
TRA and DOI (combination)	Karahanna et al., 1999
4. Theory of Planned Behaviour (TPB)	
TAM, TPB, and the decomposed Theory of Planned Behaviour (comparison)	Taylor and Todd, 1995
TBP	Ajzen, 1991[12]
TAM and TPB (comparison)	Mathieson, 1991
5. Unified Theory of Acceptance and Use of Technology (UTAUT)	
UTAUT combines eight models: TRA, TAM, and TPB	UTAUT combines eight models: TRA, TAM, and TPB
6. Model of the ICT Implementation Process	Cooper and Zmud, 1990 [13]
7. Information Systems Success Model	Delone and McLean, 1992 [14]
8. EMRs Adoption Model HIMSS Analytics	R. Hersh and A. Wright, 2008 [15]

C. Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT has been applied in different healthcare institutions. This paper tries to answer the following question; what is the user's attitude towards accepting IT? UTAUT was introduced by Venkatesh, et al. [16], who has presented four main factors including Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC) as being key influences on the adoption of IT. These four main factors are independent variables, the behavioural intention was one of the key predictors of the technology use, but this was in turn influenced by the four factors below.

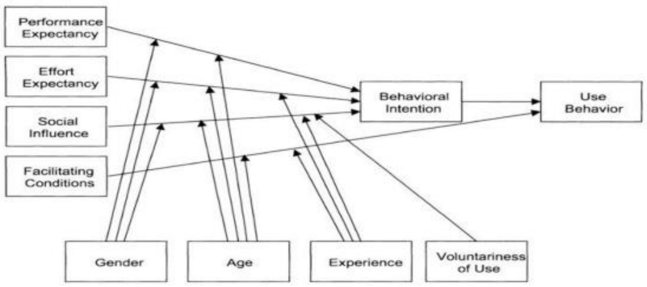

Fig1. Venkatesh, et al. [16]

According to Venkatesh, et al. [16] as having said previously there are four elements that have the influence on the UTAUT theory. First of all, performance expectancy, which is the degree to which individual behaviour using the system, will help him or her to attain gain in job performance. Both gender and age, are hypothesised to moderate the influence on behavioural intention. Secondly, effort expectancy, which is the degree to which individual, perceives that significant others believe the users should use the new. Effort expectancy is hypothesized to moderate the influence on behavioural intention by experience, age and gender. The third element is social influence, which is described by Venkatesh as the degree to which an individual perceives that others believe the social should use the new system. Social influence, hypothesized to moderate the influence on behavioural intention by gender and age, and experience, and volunteers of the system. Lastly, according to Venkatesh, et al. [16] facilitating condition is the ability to which an individual believes that an organizational and technical infrastructure able to support the use of the system, hypothesized to moderate the influence on behavioural intention by age, and experience.

III. PROBLEM STATEMENT

Adopting EMRs has been a serious problem facing public healthcare industry for the last decade. The IT staffs need to have a clear way to reduce the problem that facing the adopting of e-health system. The main problem was the difficulty of user's acceptance, who disagreed on using technology unless to fix sub-issues such as privacy, duplicated the work, and weak infrastructure. To approve the statements researchers were proposed several methods to combat this. The most creative method was used is a qualitative face-to-face interview with users which allow participants to explain the main problem and sub-problem statements.

IV. RESEARCH METHOD

The majority of both anthropology and social science scholars are approached through qualitative method. There are several reasons behind the selection of qualitative research. There is no doubt that "Qualitative research is well suited for description, interpretation, and explanation" [17]. In fact, the reason for choosing a qualitative methodology revolves primarily around the type of question or problem to be explored. Questions that begin with how or what lend themselves to qualitative study [17] and [18] whereas questions about why are more appropriately approached from a quantitative perspective [18]. The how or what questions arise because little is known about the problem or phenomenon being studied [19] and [20]. Either no theory exists or the existing theory is underdeveloped and cannot explain a phenomenon adequately [21] and [18].

However, several important articles are justifying why using the case study approach. As most of scholars agreed that there is no doubt the case studies are widely used in the social sciences and organizational studies. The qualitative case study is described as an approach to research that helps exploration of a phenomenon within its context using a variety of data source [22]. Both Robert and Yin illustrated the two main key approaches to guide case study methodology. Both the Forchuk and Roberts [23] agreed that the case study method is used to ensure that the topic of interest is well explored, and that the essence of the phenomenon is revealed. According to Yin [24] a case study is designed to consider when the focus of the study is to answer "how" and "why" questions; secondly when it cannot manipulate the behaviour of those involved in the study; thirdly when it wants to cover contextual conditions because it believe they are relevant to the phenomenon under study; lastly the boundaries are not clear between the phenomenon and context.

Ten interviews were carried out within the public hospital. These were across both the clinical and administrative staff. These were followed with requests for further information and clarification. Secondary data was obtained using documents provided as part of the interviews, websites and annual reports.

V. RESULTS

A. *Ohud Hospital case study*

Ohud Hospital is a public hospital with 261-bed on the outskirts of Madinah Al Munawara, Saudi Arabia. The hospital also contains a residential campus where the hospital doctors and nurses reside. In 1980, it started its life as a charity hospital called Badr Al-Khairi and because it was well constructed and neat, it was taken over by the Ministry Of Health (MOH). An identical campus is also located on the outskirts of Mecca. Emergency and traffic accidents cases in Madinah and areas around are referred to it since the clinical capacity reaches 1500 patients per 24 hours.

Ohud hospital has implemented the OASIS by using "Balsam United" as vender of hospital management information system. Balsam United is a leading provider of healthcare solutions in Saudi Arabia. The main health system is OASIS "Open Architecture Specialized Information System

"HMIS" Hospital Management Information System". OASIS is developed to support and fulfil the requirements for healthcare professionals by providing a full and secure access for controlling and processing the relevant information when and where it is needed. OASIS is a comprehensive system and provides a wide range of facilities such as clinical, specialty, financial and administrative systems. At the same time, the system is modular in design, with modules addressing specific functional requirements. Balsam can implement individual modules of OASIS on a stand-alone basis and integrate with other modules as and when they come on-line all OASIS modules are integrated into a cohesive and robust system.

The main challenge for the IT department is that users using the system. IT staff has carried out training with the clinical staff monthly. However, most of the users of the system are of an older generation and they prefer using paper-based systems. Also, the biggest IT challenges are the computer networks that link in the hospital. There is a high loading on the system and there are high users demand. On the other hand, there are several benefits found regarding of using OASIS. IT department staff mentions that using OASIS brings realistic and credible statistics. Additionally, using the OASIS can help by backing up the data every week. Thus, data is not lost which has happened in the past. It is important to mention that there is no specific model that to use to adopt OASIS. Rather it was implemented hap hazardly and as such not all parts of the system are fully utilised.

It was evident from the interviews that there were no clear steps to implement the technology. This was a major difficulty during implementation. Many interviewees agreed that there were no clear steps to implementing Oasis. The participant 4 reported that there is need for top management to clarify the steps to implement the technology. The quotation presented below.

> *"There were no steps, but we do some meeting with top management to make the clear process to implement the technology." (20-21, P4/OH. Administration staff).*

However, there were few participants disagreed with that. They mentioned that there had been several attempts to establish a process to implement Oasis. Firstly, the IT staffs start by explaining the users about the system before starting to train them which can take a view weeks. Secondly, the IT staffs improve the system with vendor and fixing the feedback from users. Normally, the process of implementing the system took a few months. The interviewees highlighted that there was good support from vendor. The quote below illustrates these steps.

> *"Yes, we have. In general, we start by establishing the system then checking lastly training the users." (55, P1/OH. Head of the E- health)*

> *"There is no particular model or procedure the main step is the developer set up with the user and develops the steps that he/she needs to implement IT. The developer can develop the system by changing models step by step with contacting the vendor.." (34-37, P1/OH. IT specialist).*

B. King Fahad hospital in Madinah

King Fahd Hospital is public a governmental hospital in Madinah Munawarah in Saudi Arabia, which was built in 1980. It's one of the five hospitals of the same name, which were built in the era of King Fahad Bin Abdulaziz in different regions in the kingdom. It is considered as a medical landmark as it is the largest comprehensive contemporary health care provider of the Ministry of Health in Madinah region. Emergency and traffic accidents cases in Madinah and areas around are referred to it since the clinical capacity reaches 500 beds. King Fahd Hospital includes several clinics centre such as specialized dental centre, diabetes care centre, Tele-Health centre, and kidney diseases centre.

The core health information technology that adopted in King Fahad hospital is called "Medical-plus". This system is as such links the patient's health record with different departments. Clinical staff must have a user ID and password, which allows them to report, diagnose and see the laboratory results. Patients have their number that is unique and links with a system generated code number. IT department has cooperated with gulf company "vendor" to implement the system. The medical plus system was adopted within five years' period. There were of course a high number of challenges and issues that will be discussed. It was found again that there was no specific model to adopt the systems. Both clinical and IT department have not developed any explicit knowledge arising from the adoption of the technology. The researcher has found that the users have preferred to use paperwork rather than using the system. The main reason behind that is that old consultant's users have less knowledge about how to use the system and how to dealing with technology. Users have mentioned that using paperwork can reduce the time of waiting list in the Out Patients Department. There is no doubt that technology such as Medical plus system has more positive impacts than paperwork but users have not fully accepted the new technology even after a 5-year implementation.

> *"The staffs of IT give us courses for how to use the system. There is no shared of how to implementing the system or sharing the feedbacks between health*

professionals." (21-22, P4/KFH. Health professional).

VI. Discussion

This research has applied the model UTAUT based on the findings of two public hospitals in Madinah. The results indicated that the main factors influencing adoption of technology are Performance Expectancy (PE), Effort Expectancy (EE), The Social Influence (SI), and Facilitating Conditions (FC). These act as significant deterrents to users' behavioral intention. Additionally, the modulators approached the following factors genders, ages, and voluntariness of use, which totally indirectly impacted on the majority of factors.

A. Performance Expectancy (PE):

Performance Expectancy (PE) is an extremely important factor that influences the adoption of EMRs in both hospitals. The finding from both cases highlighted as positive the factor (PE). In this study, PE used is the degree to which the users believe that using EMRs services can help him or her to facilitate communication with patients regarding of benefits which including saving time and cost, improving the quality of health services, as well as improving governmental spending. The research results support that PE positively predicts behavioural intention to use EMRs services. The Effect of (PE) on (BI) was significant and strong and reflects the anticipated benefits obtained from using EMRs services in both hospitals. This demonstrates that the public's performance expectations for EMRs services might be improved by focusing on the usefulness of EMRs services and availability of such modern technology channels. In other words, if the advantages and benefits of using EMRs were demonstrated and promoted to public patients as well as to all of operations and management staff, the acceptance and use of EMRs would most likely to increase in both hospitals.

B. Effort Expectancy (EE):

The Effort Expectancy (EE) variable in this study was explained as the degree of ease associated with the use of health information technology based on EMRs in public hospitals. It was clearly measured by the perception of ease of learning and using these systems and how much effort could be spent to use these systems. It is important to mention that the link between (EE) and (BI) has benefits. There is a positive link, which confirms that users like to adopt an easy to use system, which demanded little effort and less time than old methods to accomplish their electronic methods. Furthermore, this was an important influence of (EE) which can be supported by providing simple EMRs services, improving the quality of services using simple and easily understood words and phrases, providing health web based assistance tools as well as declaring the procedures and instructions for all services.

C. The Social Influence (SI):

The social influence (SI) was explained as the extent to which an individual perceives others' options in planning to use health information technology in health services. It was measured by the perception of how social communication impact on users' intentions to use in EMRs services. The main study result clearly revealed an insignificant effect of (SI) on (BI) to use EMRs. Thus, this one cultural impact is to adopt the technology, which is clearly illustrated in the several studies. Additionally, Social Influence (SI) affect users in the both cases in their willingness to adopt EMRs, although it has an impact on the user's confidence, ability and self-esteem to use the electronic system, rather than other beliefs as well as options. Furthermore, this result indicates that the EMRs services are a personal and individual issue, an important effect by (SI). This confirmed by Venkatesh et al. (2003), which stated as the usage of a system depends on individual user's beliefs, rather than on other's opinions of advice.

D. Facilitating Conditions (FC):

In this paper, Facilitating Condition (FC) refers to the availability of IT and organizational recourses that used to support, the use of EMRs. It was measured by assessing the perception of accessing the required recourses, the need of knowledge, as well as the technical support need to use to build EMRs. The study results approved that Facilitating Condition (FC) have a direct and significant impact on usage behaviour of EMRs in both cases. That result supports the basic link between that facilitating condition (FC) and usage behaviour. With respect to two public hospitals in Saudi Arabia, (FC) which include ICT infrastructure of government sectors, technical support, Internet websites and any other available services to improve the help individuals to adopt and use health technology services. Consequently, it is important to improve (FC) in terms of both human resources and electronic health to improve the adoption of EMRs.

TABLE II
SUMMARIES THE KEY FINDINGS

Factors influencing adoption of technology UTATU theory	***Ohud Hospital (OASIS system)***	***King Fahad hospital (Medical-Plus system)***
Performance Expectancy (PE)	Positive including (saving time and cost, improving the quality of health services, and improving governmental spending).	
Effort Expectancy (EE)	Easy of learning, little effort and less time. Improving the quality of services by simple words and phrase and providing health web based assistance tools which declaring the procedures and instructions for all services.	
The Social Influence (SI)	Cultural impacts, the user's confidence, ability and self-esteem to use the systems.	

Facilitating Conditions (FC)	ICT infrastructure of government sectors, technical support, Internet websites and any other available services to improve the help individuals to adopt

VII. Conclusion

In this paper, research findings on the influence of adoption health information technology (HIT) on Saudi public hospitals are presented. The initial theories are drawn from the literature on implementation and adoption of ICT specifically by addressing UTAUT theory. The need for the adoption of health technology by public hospitals in Saudi Arabia is threefold. Firstly, it has been recognized that the influence of the (HIT) on the adoption and health innovation has received little attention in previous research. Secondly, the paper provided the key factors to that influence the adoption of technology in healthcare to provide better quality patients services by using (UTAUT) model. Third and finally, the paper sets out to test a theoretical model, which can draw a clear picture of the current challenges to implementing of (HIT) related to EMRs. In particular, it tries to identify the specific steps for implementation by using (UTAUT) model. In terms of future research, this paper can be utilized for more complex new technology adoption.

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