Constructing the Network of Influence Model: an evidence-based theoretical framework to improve the implementation of Health Information Technology in developing countries

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This thesis is submitted in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy of the University of Portsmouth.

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December 2017
Abstract

Introduction

Electronic Health (e-Health) and Health Information Technology (HIT) projects offer considerable potential benefits for both health professionals and patients. In developed countries, the technology is beginning to reach maturity, with a number of HIT products available to monitor health and well-being. Academic studies have also reported on the rollout of such systems in developing countries. However, the rate of failure remains extremely high, and there is a lack of empirical evidence from many developing countries in relation to how their IT solutions are implemented and evaluated.

Aims

The purpose of this research is to develop a new theoretical framework to critically evaluate the factors that influence the implementation of HIT in developing countries broadly and specifically in relation to Libya. It is intended that the ultimate model assists in (a) combating the high failure rate of HIT projects and (b) specifying significant adaptations for the Libyan Government to consider in relation to future HIT projects that might reduce the risk of failure.

Research questions

This thesis seeks the answer to five research questions:

RQ1. What distinct factors should be taken into consideration when HIT projects are implemented in developing countries compared to developed countries?

RQ2. To what extent has HIT been deployed in developing countries?

RQ3. What factors influence the success/failure of the adoption of HIT in developing countries?

RQ4. To what extent have HIT systems been deployed in Libya?

RQ5. What implementation metrics are being used in HIT projects in developing countries to measure success?
Methods

A comprehensive literature review of ICT projects in both developed and developing countries was undertaken and the results of that research distilled and condensed into the first version of the Network of Influence Model. Two mixed methods studies were conducted to collect qualitative and quantitative data. A Constructivist Paradigm was applied in analysing these data to produce version 2 of the model. A modified Delphi study approach was then applied to the model itself to test its suppositions and veracity.

Results

Version 1 of the Network of Influence Model (NIM) was derived from secondary research. It attempts to model, at a high level, the factors that influence the adoption of HIT in developing countries. Version 2 (updated from primary research) attempts to model the complex relationships between these factors. A knowledge gap was identified in the published literature in relation to Libya, where it seems no assessments of ICT solutions in any profession have taken place at all.

Conclusions:

Based on the research findings, a novel evidence-based theoretical framework has been developed for addressing the drivers and barriers of HIT technology in developing countries. The network of influence model identifies the following definitive factors which have not been previously highlighted in the literature: brain drain, capacity building, evidence base, and organisational memory. These factors have a profound impact on the success or failure of the HIT systems in developing countries. This research can practically provide realistic guidance for the stakeholders involved in the process of planning, developing, implementing, using and adopting health information technology in developing countries. The model created should assist with the future study of any healthcare ICT solution implemented in a developing country. Although it did not prove possible to answer some of the research questions posed in full, the data obtained correlated with the suppositions made by the model.
Table of Contents

Abstract ............................................................................................................................. 2
Table of Contents ............................................................................................................. 1
List of tables ..................................................................................................................... 7
List of figures .................................................................................................................... 8
Glossary of acronyms ...................................................................................................... 10
Declaration ....................................................................................................................... 11
Acknowledgments ........................................................................................................... 12
Research Dissemination ................................................................................................. 13

1 Introduction ............................................................................................................. 15
   1.1 Background ......................................................................................................... 15

1.2 Information Technology Success and Failure ................................................... 15
   1.2.1 Information Systems Success .................................................................... 17
   1.2.2 Information Systems Failure ..................................................................... 18
   1.2.3 HIT Concept and Definition ..................................................................... 19
   1.2.4 HIT Projects Success From Different Stakeholders’ Perspectives .......... 22

1.3 HIT and The Missing Evidence ........................................................................ 23

1.4 HIT and National Context ................................................................................. 23

1.5 Research context ............................................................................................... 25
   1.5.1 Libya Demographic profile ........................................................................ 25
   1.5.2 e-Initiatives in Libya .................................................................................. 26
   1.5.3 Healthcare profile in Libya ........................................................................ 27

1.6 Aim and objectives ............................................................................................ 28
   1.6.1 Aim ............................................................................................................ 28
   1.6.2 Research questions ................................................................................... 28
   1.6.3 Objectives .................................................................................................. 29
   1.6.4 Rationale and Significance of the Research .............................................. 29
   1.6.5 Benefits for Patients .................................................................................. 29
   1.6.6 Benefits for Healthcare Providers and the Organisations ........................ 30
   1.6.7 Need for Theory Building .......................................................................... 31

1.7 Structure of the thesis ......................................................................................... 31
2.8.3 Human Factors ................................................................. 70
2.8.4 Organisational Factors ....................................................... 70
2.8.5 Financial Factors ............................................................... 71
2.8.6 Legal Factors ................................................................. 71
2.8.7 Academia ........................................................................ 72
2.9 Conclusion ................................................................................ 73
3 Research Methodology ............................................................... 75
  3.1 Introduction .............................................................................. 75
  3.2 Methodological choices .......................................................... 75
  3.3 Overview of research methods ................................................... 76
    3.3.1 Philosophical Paradigms of Research ....................................... 76
    3.3.2 Positivism ........................................................................ 76
    3.3.3 Social Constructivist ............................................................ 77
  3.4 Research Approaches and Designs ................................................. 80
    3.4.1 Quantitative Designs ........................................................... 80
    3.4.2 Qualitative Designs .............................................................. 80
    3.4.3 Mixed Methods Designs: ....................................................... 81
    3.4.4 Qualitative strategies: ........................................................... 82
  3.5 Quantitative Strategies .......................................................... 83
  3.6 Research Objectives and Questions ............................................. 85
  3.7 Research methods selection and justification .................................... 86
    3.7.1 Social Constructivist Paradigm .............................................. 86
    3.7.2 General Justification for using Mixed Methods as the Research Strategy 86
  3.8 Qualitative methods ............................................................... 89
    3.8.1 Grounded Theory ............................................................... 89
    3.8.2 Case Study Research ............................................................ 90
  3.9 Research Ethics Aspects .......................................................... 93
  3.10 Overall Research Methodology ............................................... 94
  3.11 Nature of Data Collected Through the Research Programme ............ 96
### 3.12 Conclusion

The case study of the Libyan wounded personal in Greece

### 4 Introduction

#### 4.1 Introduction

#### 4.2 Methods:

#### 4.2.1 Study Participants

#### 4.3 Results

#### 4.4 Discussions:

#### 4.5 Conclusion

HIT in Libya with special focus on mHealth (Study 1)

#### 5.1 Introduction

#### 5.2 Methods

#### 5.2.1 Literature Review

#### 5.2.2 Questionnaire Survey

#### 5.2.3 Sample and Data Collection

#### 5.2.4 The Pilot Study

#### 5.2.5 The Respondent Recruitment Process

#### 5.2.6 Data Collection Technique and Protocols

#### 5.3 Results

#### 5.3.1 Demographics

#### 5.3.2 Mobile Phones Access and Use

#### 5.3.3 The Awareness of the Use of Mobile Devices in Healthcare Delivery

#### 5.3.4 Factors which could encourage people in Libya to use mobile devices to access health information

#### 5.3.5 Qualitative Data

#### 5.3.6 Keeping Data Electronically

#### 5.3.7 Factors Which May Help/Hinder The Implementation of m-Health

#### 5.4 Age and Education Sample Bias

#### 5.5 Conclusion

Exploring The Critical Success Factors and the Development of Version 2 of the Network of Influence Model (Study 2)

#### 6.1 Introduction
6.2 Methods ........................................................................................................... 116
  6.2.1 Pilot Survey .............................................................................................. 116
  6.2.2 Main Survey ............................................................................................. 117
  6.2.3 Reliability ................................................................................................. 118
6.3 Results ............................................................................................................. 118
  6.3.1 Demographics ......................................................................................... 118
  6.3.2 Organisational Readiness to Implement HIT Systems ............................ 123
  6.3.3 Level of Influence of Factors ................................................................... 127
  6.3.4 Identified barriers ................................................................................... 129
6.4 Discussion ....................................................................................................... 131
  6.4.1 Data saturation ....................................................................................... 132
  6.4.2 Version 2 of the Network of Influence Model ........................................ 133
  6.4.3 Analysis of the factors ............................................................................. 134
6.5 Conclusion ...................................................................................................... 144

7 Validation of Research Findings (Study 3) ............................................................. 145
  7.1 Introduction .................................................................................................. 145
  7.2 Methods ....................................................................................................... 145
  7.3 Results ........................................................................................................... 146
    7.3.1 Demographics ....................................................................................... 146
    7.3.2 Some of The Emerged themes .............................................................. 147
  7.4 Purposive Sampling ..................................................................................... 150
  7.5 Multiple coding ............................................................................................ 151
  7.6 Respondent Validation ................................................................................ 152
  7.7 Methodology for Respondent Validation .................................................... 152
  7.8 Validation of the Factors and relationships ................................................. 153
    7.8.1 Validation of the Model Prototype ....................................................... 153
  7.9 Chapter summary ......................................................................................... 153

8 Discussion and Conclusions ............................................................................... 154
  8.1 Introduction .................................................................................................. 154
List of tables

Table 1-1 Some definitions of e-Health from various sources. ......................................... 21
Table 2-1 Research questions’ numbers for quick reference ........................................... 35
Table 2-2 Research methods and data collection tools..................................................... 37
Table 2-3 Factors and their references in the literature ................................................... 39
Table 2-4 List of countries reported in the literature ....................................................... 49
Table 2-5 Number of studies in each category .............................................................. 51
Table 3-1 Contrasting implications of Positivism and Social Constructivist .................... 78
Table 3-2 Differences between positivist and interpretivist approaches ....................... 79
Table 3-3 The difference between the three designs...................................................... 82
Table 3-4 Comparison between the five approaches ..................................................... 83
Table 3-5 Type of quantitative design .......................................................................... 84
Table 3-6 Nature of data collected through the programme .......................................... 96
Table 5-1 shows the age distribution of the respondents............................................... 107
Table 5-2 Level of education of survey respondents ..................................................... 107
Table 5-3 Ownership of mobile device usage by type ............................................... 108
Table 5-4 Awareness of the use of mobile devices in healthcare delivery .................... 109
Table 5-5 Demographics of the interview participants ............................................... 110
Table 6-1 Age distribution of the survey participants ............................................... 120
Table 6-2 Gender distribution of the survey participants ............................................. 120
Table 6-3 Implementation of HIT systems .................................................................. 121
Table 6-4 Professions distribution of survey participants ............................................. 122
Table 6-5 Level of Education of survey participants ................................................... 123
Table 6-6 Organisations readiness and factors which could affect HIT systems
implementation ............................................................................................................. 124
Table 6-7 Influence of factors ..................................................................................... 127
Table 6-8 Factors which are considered by the participants to be barriers .................. 130
Table 7-1 participant’s information took part in the model validation ......................... 146
Table 8-1 shows illustrates the research questions, the research strategy adopted and
the overall findings .................................................................................................... 157
List of figures

Figure 1-1 Map of Libya and its borders (CNN, 2011) .............................................................. 26
Figure 2-1 Process of the structured literature review and the sources of the literature .......................................................................................................................... 38
Figure 2-2 The distinct factors for developing countries....................................................... 48
Figure 2-3 The various applications of HIT in India............................................................... 50
Figure 2-4 Distribution of studies in different regions of the world...................................... 51
Figure 2-5 The various application of HIT in developing countries. ...................................... 52
Figure 2-6 Diagrammatic illustration of factors identified ...................................................... 53
Figure 2-7 The ITPOSMO dimensions of health information system design......................... 55
Figure 2-8 Human-organisation-technology fit (HOT-fit) .................................................... 56
Figure 2-9 the contextual implementation model..................................................................... 57
Figure 2-10 TAM model........................................................................................................ 58
Figure 2-11 Network of Influence Model identifying the factors that influence HIT adoption .................................................................................................................. 66
Figure 3-1: The interconnection of worldviews, strategies of inquiry and research methods. ..................................................................................................................... 75
Figure 3-2: illustrates the overall research methodology....................................................... 95
Figure 5-1 Factors which may encourage/discourage people to use mobile devices. ....... 111
Figure 5-2 Respondents’ views on keeping data electronically............................................. 112
Figure 5-3 Factors Affecting the Implementation of m-Health services in Libya................. 113
Figure 6-1 Distribution of countries amongst survey participants......................................... 119
Figure 6-2 Professional distribution of the survey participants............................................ 121
Figure 6-3 Organisational readiness and factors which could affect HIT systems implementation .................................................................................................................. 126
Figure 6-4 Factors and their level of influence. .................................................................... 129
Figure 6-5 Factors which are considered by the participants to be barriers........................ 131
Figure 6-6 Version 2 of the Network of Influence Model................................................... 133
Figure 6-7 Themes emerging from analysis of the interviews.............................................. 143
Figure 7-1 illustrates theme A.1 ......................................................................................... 147
Figure 7-2 theme A.2 ........................................................................................................ 148
Figure 7-3 theme A.3..................................................................................................... 148
Figure 7-4 theme A.4..................................................................................................... 149
Figure 7-5 theme A.5..................................................................................................... 149
Figure 7-6 theme A.6..................................................................................................... 150
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>CIM</td>
<td>The Contextual Implementation Model</td>
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<tr>
<td>CPOE</td>
<td>Computerised physicians order entry</td>
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<td>CSFs</td>
<td>Critical success factors</td>
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<tr>
<td>CTF</td>
<td>Conceptual Theory Framework</td>
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<td>DSS</td>
<td>Decision support systems</td>
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<td>e-Health</td>
<td>Electronic health</td>
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<td>EMR</td>
<td>Electronic medical records</td>
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<td>GT</td>
<td>Grounded theory</td>
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<tr>
<td>HIT</td>
<td>Health information technology</td>
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<td>HOT</td>
<td>Human-Organisation-Technology</td>
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<td>ICTs</td>
<td>Information and communication technology</td>
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<td>IT</td>
<td>Information technology</td>
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<td>LICs</td>
<td>Low income countries</td>
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<td>LMICs</td>
<td>Lower middle income countries</td>
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<tr>
<td>mHealth</td>
<td>Mobile health</td>
</tr>
<tr>
<td>MoH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>NIM</td>
<td>Network of influence model</td>
</tr>
<tr>
<td>PACS</td>
<td>Picture archiving and communication system</td>
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<tr>
<td>PDAs</td>
<td>Personal digital assistant</td>
</tr>
<tr>
<td>PHR</td>
<td>Personal health records</td>
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<tr>
<td>TAM</td>
<td>Technology Acceptance Model</td>
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<td>UMICs</td>
<td>Upper middle income countries</td>
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<td>WHO</td>
<td>World health organisation</td>
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Declaration

Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

Haythem Nakkas
December 2017
Acknowledgments

First of all, I am grateful to Allah (God) who gives me the strength to carry out this research.

I would like to express my appreciation and deepest gratitude to Dr Philip Scott, Senior Lecturer, for his support, encouragement, feedback, thoughtful guidance and critical comments throughout the years of this research.

Dr Kate Dingley and Professor Jim Briggs for their helpful research supervision. My special thanks to Dr Tineke Fitch, for her constructive feedback during the mock viva.

I am also indebted to my father Abdulkareem for his sacrifices and unlimited support over the years, I think no words can describe how much I am grateful to him and my late mother (Turkia) who passed away in 2008 may Allah bless her soul.

I would like to thank my wife Hanan for her patient, support over the years and not complaining when I needed some time for the PhD even during the weekends. My warmest love goes to my son Mohammed who was born half way through my PhD and has brought lots of happiness to our life.

Finally, great thanks to my brothers and sisters for their encouragement, prayers and help over the years, I am very proud of every one of you.
Research Dissemination

**Journal article:**


**Presentations:**

- “Exploring the critical success factors in health information technology in developing countries”, *Healthy Computing Workshop*, University of Portsmouth, 22 May 2013.

- Exploring the critical success factors in health information technology in developing countries”, *27th Annual Plenary & Working Group Meeting*, Health Level Seven® (HL7), Cambridge, USA, September 2013.

- “Barriers and facilitators that may influence the implementing in health information technology in developing countries”, *School of Computing Research Seminar*, University of Portsmouth, 08th January 2014.


**Conference posters:**


- “Barriers and facilitators that may influence the implementing in health information technology in developing countries”, *Faculty of Technology Conference*, University of Portsmouth, June 2015.
Foreword

Please note that the terms HIT and e-Health are used interchangeably through the course of this thesis.

Please also note that, in this thesis, “developing countries” refers to: Low-Income Countries (LICs), Lower-Middle-Income Countries (LMICs) and Upper-Middle-Income Countries (UMICs) as defined by The World Bank (2016).

Please note all the academic papers that are referenced throughout this work are primarily concerned with developing countries, rather than developed ones. This point has been made here because the narrative sometimes does not lend itself to specifically pointing this out and, on some occasions, previous studies are referenced with phrases such as “According to Weeks et al. (2009), developed countries are...” and the reader may otherwise come to the incorrect conclusion that the referenced work is concerned with a developed country rather than a developing one.

Finally, unfortunately, due to the turbulent political times Libya is currently experiencing, gathering research from that country proved difficult. A full discourse of the problems encountered is outlined in Chapters 3, 4 and 5. Despite the difficulties, surveys of Libyan healthcare professionals were conducted. This being the case, it was considered reckless to assert that the findings would specifically apply to Libya. Instead, the models proposed became the primary focus of the thesis, with a recommendation for future research to be conducted in Libya with the models as a reference tool.
1 Introduction

1.1 Background
This thesis introduces the Network of Influence Model (the NIM), a model identifying the factors that influence the adoption of Health Information Technologies (HITs) in developing countries. The model represents the culmination of a long period of research into these factors and this thesis explains the methodology behind its construction.

1.2 Information Technology Success and Failure
E-health is “the use of information and communications technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature and health education, knowledge and research” (Blaya et al. 2010). Recently, there has been some debate amongst academic researchers into the introduction, deployment and evaluation of e-Health in the context of developing countries.

The conclusion seems to be that the use of ICTs in developing countries is inevitable, hence the debate has now shifted to how such technologies can be effectively introduced, ensuring sustainability over time (Fenenga & de Jager, 2007; Kapiriri & Bondy, 2006; Measham et al., 2006; Walsham & Sahay, 2006). Several studies (Blaya et al., 2010) have reported that IT projects are not always successful across all the sectors of the economy in developing nations. However, there has, until now, been little research into the construction of a model which might assist those involved in that implementation in delivering a successful IT solution.

There are myriad reasons as to why this may be the case. Firstly, there is a distinct lack of evaluations of delivered e-Health solutions per se. Secondly, in the few cases where an evaluation has been carried out, then there is often a question as to whether those who have carried out the evaluation have truly done so independently. Finally, there is some suggestion that the novelty factor of a “new” technology solution can impact the results of an evaluation.
When there is even some debate as to the meaning of the terms “success” and “failure” in relation to e-Health, there is clearly a need at the outset to have defined goals for any proposed e-Health solution. IT projects fail due to various different factors. These could be due to problems with the design of the system, user-related issues, budget constraints or overspends, operational problems, time limits and/or a mismatch between the software produced and the organisational processes or structures it was attempting to model (Zahran & Galal-Edeen, 2012).

Jiang & Klein (1999, cited in Fitzgerald & Russo, 2005) reported that only 16% of IT projects were accomplished on time and within the specified budget. Fitzgerald and Russo (2005) also found that approximately half of all IT projects exceeded their budget and their schedule and that nearly a third of all IT projects were abandoned completely. Another study has reported the rate of failure in IT projects can be as high as 70% in developed countries (Kaplan & Harris-Salamone, 2009). A 2010 critique of the implementation and evaluation of over 30 ICT projects in developing countries (Blaya, 2010) recommended that an independent evaluation should be “made a requirement for implementation”.

Lyytinen & Hirschheim (1988) cited by Fitzgerald & Russo (2005) classified failed IT projects into one of four categories:

(a) correspondence failure, when a system fails to meet its pre-determined objectives

(b) process failure, when a system exceeds its specified time and budget or if the system is never actually implemented at all

(c) interaction failure, when a system meets the technical specifications but does not meet user requirements, and

(d) expectation failure, when a system is unable to meet particular stakeholders’ expectations.

This can be very challenging, particularly as there are often several stakeholders involved in implementing or adopting IT systems in healthcare.
Success and failure are generally difficult words to define, because they can be interpreted differently by the stakeholders involved in the same project, and different stakeholders may have different interests in the project. On one hand, for example, a national HIT system may be classed as a success by the government if the project is merely delivered on time and within the estimated budget. On the other hand, if the eventual users were not involved in its production and consequently find it impossible to use, those users would naturally consider that same HIT system a failure.

In developed countries, the failure rate of HIT projects has been researched extensively. On the other hand, when it comes to adopting IT to support healthcare, many developing countries remain at an early stage (Greenes, 2014). When a country’s resources are very limited, and people are struggling to secure food to eat, the government must invest carefully in such technology. This section of the chapter addresses the current landscape regarding HIT success and failure.

1.2.1 Information Systems Success

Several studies have been published over the past decades trying to define what constitutes an IT project success. DeLone and McLean proposed Technology Acceptance Model (TAM), arguing that success is a distinguished dependent variable in the field of IT (DeLone & McLean, 1992, 2003; Petter, DeLone, & McLean, 2008). They have produced a taxonomy of six variables which they believe interrelate:

(a) System(s) quality,
(b) Information quality,
(c) Use,
(d) User satisfaction,
(e) Individual impact, and
(f) Net Benefits.

Since the model was published in the early 1990s and its updated versions, several studies have been published to examine, change, or extend the notion of IT systems success (Dwivedi, Kapoor, Williams, & Williams, 2013; Larsen, 2003; Petter et al., 2008;
In developing countries, the rate of failure is even higher and it is as high as 70% (Heeks, 2002; Hu, Xiao, Pang, & Xie, 2005). Despite the effort and research put into identifying what factors impact upon the successful implementation of an IT project, the failure rate remains high across the different sectors of the industry (Dwivedi, Henriksen, & Wastell, 2013). Kivijärvi & Zmud (1993) cited by (Averweg & Erwin, 1999) stated that one of the most important challenges implementation research has to contend with is to define and measure the success of IT projects.

Some factors are common to an implementation of an ICT solution notwithstanding the field in which it will be deployed, for example: authentication and security, usability, user’s training. However, some factors are almost unique to healthcare, such as pharmacovigilance (the study of science and activities relating to detection, assessment, understanding and prevention of adverse effects or any other drug-related problems) and enforced interoperability standards. Implementing a HIT system needs to encompass well-defined standards for interoperability and comply with legal requirements (Kaplan & Harris-Salamone, 2009).

IT project failure is a huge research area in its own right. This thesis does not, therefore, list all references related to the existing debate about project failure in every sector of the economy. Mainly, this thesis will focuses on the implementation of IT in the healthcare sector in developing countries.

### 1.2.2 Information Systems Failure

It has been reported that HIT often fails due to sociotechnical, cultural, and financial factors (Kaplan & Harris-Salamone, 2009). For example, in the United States of America, the failure rate of HIT projects may be as high as 50% (Kaplan & Harris-Salamone, 2009; Paré, Sicotte, Jaana, & Girouard, 2008).

This is despite the fact that quite a considerable number of research studies have investigated, and identified, the best practices of achieving success. If the 50% failure
rate of HITs is accurate, it would appear to be only slightly higher than the failure rate across industry as a whole. Kaplan & Harris reported that, across industry sectors, “at least 40% of such generic IT projects either are abandoned or fail to meet business requirements, while fewer than 40% of large systems purchased from vendors meet their goals”. (Kaplan & Harris-Salamone, 2009, p. 291).

1.2.3 HIT Concept and Definition

HIT is considered to be a relatively young research field and, as with the advancing technologies it is powered by, it is maturing at a fairly swift pace. There have been studies into the deployment of numerous HIT applications, and from these we can draw a body of research that addresses the benefits stakeholders have enjoyed through modern technology.

We must also be alert to the fact that, with pace being indeed swift, the same research conducted today may not necessarily produce the exact same results. Whilst it is correct to conclude that much technology, at a conceptual/framework level, can be applied across the globe, and regardless of whether the country in question is rich or poor, this comes with one strict proviso. For whilst a well-designed and managed HIT has the potential to save people’s lives and enhance their quality of care, a poorly-designed and managed HIT has just as much potential to inflict severe harm (Cresswell & Sheikh, 2013; Han et al., 2005).

Developing countries often face their own unique challenges when compared to developed ones (Oluoch et al., 2012; Williams, 2008). For example, inadequate infrastructure, the “digital divide” (older generations being largely unfamiliar with modern computing equipment), lack of strategic planning, awareness, IT literacy, local leadership and political instability (Barjis, Kolfschoten, & Maritz, 2013; Oluoch et al., 2012; Touray, Salminen, & Mursu, 2013; Williams, 2008).

Moreover, the vast majority of these countries suffer from either a complete absence of, or the ineffective auditing of, the organisations with the ultimate responsibility for supplying the service in the first place. All of these factors increase the risk of the failure
of any HIT systems in those countries. However, the existing literature about HIT in developing countries seems to lack hard, scientific evidence in this respect.

E-Health interventions have great potential to transform the health sector for the better. However, e-Health is an area which has yet to achieve its full potential in developed counties, let alone developing ones (Wickramasinghe & Schaffer, 2009). There is a consensus among the academic community that HIT has the potential to improve the quality of healthcare and reduce costs in developing countries (Luna, Otero, & Marcelo, 2013; Wickramasinghe & Schaffer, 2009). Yet many academics recognise that HITs have not always succeeded in both developed and developing countries (Gallego, Gagnon, & Desmartis, 2010; Heeks, 2006; Heeks, Mundy, & Salazar, 1999). In spite of numerous cases which have been reported in the literature on the rollout of HIT projects across the developed and developing world, the percentage of IT project failure remains stubbornly high.

The discipline of HIT is a field which is internationally recognised and its requirements and practices are changing over time. Furthermore, it is an interdisciplinary field and includes Computer Science, Social Science, Information Systems, Information Technology, Health Science and Political Science. Because it encompasses various domains, the implementation of HIT can be very challenging.

The challenges which face the development and implementation of HIT in developing countries have been widely reported in the literature. For instance lack of funds, weak technological infrastructure, poor management, shortages of IT skills, personal issues, security issues, privacy and interoperability. (Pagliari, 2007) argue that HIT often has four main challenges which are as follows:

1. Technical challenges
2. Economic challenges
3. Social challenges
4. Legal challenges
Several definitions of HIT have been reported in the literature published over the past decade and these definitions vary between the authors across the literature and the disciplines that contribute towards HIT. A few examples are given in Table 1-1.

Table 1-1 Some definitions of e-Health from various sources.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>HIT (or, interchangeably e-Health) is...</th>
</tr>
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<tbody>
<tr>
<td>World Health Organization (2005)</td>
<td>“…the use of information and communications technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research”.</td>
</tr>
<tr>
<td>Norman and Skinner (2006)</td>
<td>“…the ability to seek, find, understand, and appraise health information from electronic sources and the application of the knowledge gained to addressing or solving a health problem”.</td>
</tr>
<tr>
<td>(Álvarez, 2002)</td>
<td>“…a consumer-centred model of healthcare where stakeholders collaborate, utilising ICTs including Internet technologies to manage health, arrange, deliver and account for care and manage healthcare systems”.</td>
</tr>
<tr>
<td>(Chattisgarh, 2004)</td>
<td>“…today’s tools for substantial productivity gains, while providing tomorrow’s instrument for restructured, citizen-centred health systems”.</td>
</tr>
<tr>
<td>(Silber, 2003)</td>
<td>“…the application of information and communications technologies (ICT) across the whole range of functions that affect healthcare, from diagnosis to follow-up. It is the means to deliver responsive healthcare tailored to the needs of the citizen”.</td>
</tr>
<tr>
<td>(Catwell &amp; Sheikh, 2009)</td>
<td>“…an emerging field of medical informatics, referring to the organisation and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally and worldwide by using Information and Communication Technology”.</td>
</tr>
</tbody>
</table>
It is beyond the scope of this thesis to investigate all HIT definitions. The aim in reproducing them is only to indicate that there is some discrepancy between scholars as to what the term means, and explore the main HIT characteristics included within the definitions proffered.

Research on HIT may be considered a “multi-disciplinary phenomenon” See (Cresswell & Sheikh, 2013). The increased use of HIT worldwide offers tools to enhance the delivery of effective healthcare services.

The field of e-Health is one of the vital elements that contribute to the development of a country's economy. In order to achieve economic development, we need to have a healthy society (Banerjee, Deaton, & Duflo, 2004; Lewis, 2006; Pagliari, 2007; Strauss & Thomas, 1998).

In most developed countries, the implementation of Information and Communication Technology (ICT) across economic sectors has generally reached a state of maturity. In developing countries however, implementation typically remains firmly in the early stages, with different sectors of the economy at higher levels of maturity than others.

HIT in developing countries is yet to be fully investigated (Ranasinghe, Chan, & Yarlagadda, 2012) and, even in developed countries, progress in HIT is still varied (Kaplan & Harris-Salamone, 2009).

1.2.4 HIT Projects Success From Different Stakeholders’ Perspectives
As noted, different stakeholders assess what constitutes the success of a HIT project in different ways, and so researchers must be alert to the “disparity of opinion” that may present itself when trying to accurately reach a conclusion in its regard (Dalcher & Drevin, 2003; Davis, 2014; Turner, Zolin, & Remington, 2009). Indeed, this disparity of opinion between different stakeholders may even apply to the initial theoretical discussions that preceded the project in the first place. In short, it may not even be ultimately agreed between the stakeholders that the factors constituting success at the outset were agreed.
The following research takes this inherent difficulty in reportage on-board. Typically, the stakeholders involved in HIT projects include, but are not limited to, policymakers, physicians, nurses, insurance companies and IT developers. The research therefore attempts to conduct its empirical studies from some of these stakeholders’ perspectives, ultimately producing a theoretical model based on the data collected in the afore-mentioned context. This includes performance of the project and the priority of the assessment criteria.

1.3 HIT and The Missing Evidence
Anecdotal evidence suggests that ICT is used in many more healthcare organisations in developing countries than those for which studies have been published (and found). Any documentation on these "missing" projects remains unknown and/or ignored. Hence, if the ICT solution failed, the organisation may attempt it again and previous research shows that organisational memories of that failure are usually not retained, leading to a vicious cycle of failure (Özdemir, 2010). Furthermore, where academic literature does exist, it is sometimes of low quality and submitted for research counting exercises rather than to disseminate and share knowledge (Scott, Prytherch, & Briggs, 2010).

The literature search conducted did not retrieve any literature pertinent to HIT in Libya, so a manual search was conducted upon the same databases to find the prevalence of Information Technology in other sectors of the economy (e.g. energy, education and banking). A combination of the following keywords in the search were used: e-Learning, e-Banking, IT - ICT adoption. This search yielded seven studies. It is interesting to note that six of these studies concerned the use of IT in the educational sector, including one study that spanned education, banking and oil. This does not mean that IT has not been used in other sectors of the economy in Libya, but there is none available to us. For all we know, there is a filing cabinet somewhere in Libya full of evidence.

1.4 HIT and National Context
It can (and indeed has) be argued that developing countries do not always need to “reinvent the wheel” in order to implement HIT solutions, and that they could export HIT software from developed countries (Heeks, 2003) or use Open Source solutions
(Fraser et al., 2012). Wickramasinghe and Schaffer (2009) suggested that, if doing so, the following four prerequisite key steps need to be addressed:

1. ICT architecture and infrastructure;
2. Standardisation policies, protocols and procedures;
3. User access and accessibility policies and infrastructure; and
4. Governmental regulation and control.

It is crucial for Libya to consider possible barriers and take the necessary precautions before attempting to implement any HIT solutions.

It is arguable that sustainable HIT can only be maintained if any barriers are successfully considered before any implementation. These barriers can range from the obvious (lack of ability to recover a lost password; see (Agoro, Kibira, Freeman, & Fraser, 2017) to the complex interplay of technical, contextual, financial, academic and social-technical issues (Table 2-3). Similar challenges to HIT initiatives are found both in developing countries and developed countries, but there are unique demands for the developing countries which need to be addressed differently along with the factors (Table 2-3).

Furthermore, each country requires the implementation of HIT to be tweaked to cope with the local requirements. Each country has its own particular political, economic and social dimensions (drivers or constraints) that might influence the development of good practice of HIT initiatives.

There have been considerable efforts by researchers in the literature to address the implementation of HIT projects and the challenges they face. However, the vast majority of the theoretical frameworks and models in the literature are conducted and discussed in the context of developed countries.

There is evidence in the literature that HIT can help to enhance the healthcare delivery in limited resources settings. Many researchers, policymakers, and healthcare providers in developing countries have proffered initiatives as to how these countries can benefit
from the advantages HIT can offer, in order to bring the standard of healthcare up to those of the developed countries.

There is, therefore, the necessity to develop a conceptual theoretical model which takes into the account the gap between developing and developing countries and the special contextual requirements of the latter. The models and frameworks which are tested and developed to help implement HIT systems in the developed countries might not be directly practical to developing countries.

1.5 Research context

1.5.1 Libya Demographic profile
Libya is a country situated in a strategically important region of North Africa and shares its borders with six countries Tunisia, Algeria, Niger, Chad, Sudan and Egypt (See Figure 1-1), with an area of 1,759,540 km². This makes it the fourth-largest country on the continent in terms of the size (World Health Organization, 2010). Most of the major cities are located on the coastline, apart from Sabha which is located in the South. It is considered to be one the wealthiest countries in the region after the discovery of oil in 1959, which the Libyan economy heavily depends on as it contributes 95% of export earnings. The population of Libya is around six million according to the latest census conducted by the Libyan Bureau of Statistics and Census and World Health Organization (WHO).
The country boasts the highest literacy and educational enrolment rates in North Africa. Literacy among the population over 15 years is 88.5% (males 93.7%, females 83.2%), which is well above that in neighbouring countries. The substantial improvements in education in the past two decades have reduced illiteracy among females from 39% in 1980 to less than 16% in 2006 (World Health Organization, 2010).

1.5.2 e-Initiatives in Libya
At the beginning of 2010 the Libyan Government started several initiatives, one of them was the National ID Programme to build a national database which will be a solid ground for modern e-services for the citizens. The project was suspended during the uprising in 2011 and resumed in 2012 and there are speculations stating that the project exceeded 10 times the original budget. Due to the lack of evidence based studies these claims are difficult to verify. What is more, the government reports never being made available to the public. Few attempts were made by the researchers of this study to contact the officials who are in charge of the National ID Programme through emails but we had no responses. The author of this from Libya and have had worked in few Libyan institutions, there is obvious absence of using methodologies and standards to manage IT projects.
1.5.3 Healthcare profile in Libya

The country provides comprehensive health care free of charge to all citizens through primary healthcare units, health centres and district hospitals. A private health sector is also emerging through government support and investment in private clinics and hospitals, although currently it has a limited role. In addition, serious attempts are being made to introduce a family physician practice equivalent to the General Practitioners found in the United Kingdom.

WHO has been working hard through its offices in countries all over the world to assess and identify key factors that could contribute in the development and improving healthcare services. In addition, WHO work very close with countries to initiate corporation plans and strategies (World Health Organization, 2010), Libya and WHO (2010-2014) Cooperation Strategy was developed to achieve the following objectives:

1. Setting up and formulating a national health policies and strategies.
2. Developing the healthcare institutions and their capacity building.
3. Priorities are always given to none communicable diseases.
4. Reforming the national health programme and supporting the private sector and encourage them to participate in the development of the healthcare services thorough the introduction of the health insurance.

However, the WHO in its report about Libya has addressed some important barriers which hinders the development the healthcare sector (World Health Organization, 2010) as following:

1. The planning department lacks the technical health policies and planning vision in the local and national level
2. Dearth of human resources development.
3. Financial management and universal coverage schemes are limited
4. The sector needs further development in terms the use of ICTs, e-records to improve decision making.
5. The management and distribution process of medicine is inadequate
6. Lack of frameworks or models that could lead to the facilitation of the cooperation and joint with the relevant sectors and institutions.
7. Paucity of the scientific research in the healthcare system.
8. ICT systems are isolated and fragile without proper communication channels between the various current programmes.
9. Lack of IT skills among healthcare professional, due to absence of training courses.
10. The IT infrastructure is very weak in the healthcare institutions in particular and the county as a whole.
11. All health records and patient information are kept manually and not computerised yet.

1.6 Aim and objectives

1.6.1 Aim
The purpose of this research is to develop a new theoretical framework in order to critically evaluate the factors which influence the implementation of HIT in developing countries broadly and specifically in relation to Libya. It is intended that the ultimate model assists in (a) combating the high failure rate of HIT projects and (b) specifying significant adaptations for the Libyan Government to consider in relation to future HIT projects that might reduce the risk of failure.

1.6.2 Research questions
This thesis seeks the answer to five research questions which are listed below.

RQ1. What distinct factors should be taken into consideration when HIT projects are implemented in developing countries compared to developed countries?

RQ2. To what extent has HIT been deployed in developing countries?

RQ3. What factors influence the success/failure of the adoption of HIT in developing countries?

RQ4. To what extent have HIT systems been deployed in Libya?
RQ5. What implementation metrics are being used in HIT projects in developing countries to measure success?

1.6.3 Objectives
In order to answer the research questions, the overall objectives of this research are as follows:

- To assess the current landscape of the adoption of HIT in Libya and developing countries
- To identify the enablers and barriers encountered during the development and implementation in respect of HIT projects in developing countries
- To address the means by which the Governments of developing countries can overcome barriers which may influence the adoption of HIT
- To validate the proposed novel theoretical framework
- To provide practice and policy recommendations and directions for future research

1.6.4 Rationale and Significance of the Research
e-Health has the potential to enhance the delivery of healthcare services and it offers enormous benefits for the various stakeholders involved in the healthcare field. For instance, it can benefit patients, care providers, policymakers and others. The following are examples of the benefits to specific stakeholders:

1.6.5 Benefits for Patients
The advancement in mobile apps can help patients with chronic diseases to self-monitor and track their own health. Furthermore, patients can communicate with their physicians to manage their conditions as a team. This approach also can help and encourage patients to pursue their treatments and catch up with their appointments.
In addition, another category of patients who can benefit significantly from the services which HIT can offer are those patients who are isolated in rural areas and who often have to wait for very long times for specialist appointments by offering patients new ways in which care can be provided. This is often the case in developing countries. As a result, patient-doctor communication can be enhanced and costs can be reduced.

1.6.6 Benefits for Healthcare Providers and the Organisations
HIT can enable a healthcare professional to have better access to current and accurate patient information in a timely manner, reducing medical error as well as improving the overall quality of care. Previous studies have shown that the use of m-Health and Electronic Medical Records (EMRs) could potentially help in saving the professional’s time, which they often spend accessing or analysing the patient’s data manually (Shekelle, Morton, & Keeler, 2006). As a result, this can help in improving the diagnoses and treatments. Finally, adopting HIT systems in healthcare organisations can help in reducing costs in the long term.

The key challenges developing nations face in implementing HIT programmes successfully may be the lack of resources; for example, lack of human capital, technological infrastructure, and funds (Heeks, 2006). There have been numerous studies published which address the adoption of HIT in the healthcare sector. However, most of these studies focus on the developed, rather than developing, nations.

In developed countries, a high-speed Internet is taken for granted. However, in developing countries, the Internet is often slow or unreliable. Usually it is only available in the bigger cities, and even then possibly at a speed which makes certain uses of it impractical. It goes without saying therefore that the populations of developing countries cannot be assumed to be familiar with it. In addition to IT illiteracy, these countries also lack IT-skilled personnel to administer the software itself. This is particularly acute in Libya, although the situation is not exceptional.
Due to these challenges, HIT services initiatives in developing countries may need to consider developing policies and initiatives which take into account the aforementioned factors.

1.6.7 Need for Theory Building

According to Sahay and Walsham (1995), research objectives can fall into one of the following categories: (a) research which aims only to refine and develop a new theory, (b) secondary research, conducted to improve the practice of a theory, or (c) research designed to bridge the gap between theory and practice.

The purpose of this thesis is to present theory-driven research which has explored the role of HIT in the delivery of healthcare in its diverse institutions and settings.

1.7 Structure of the thesis

The thesis consists of eight subsequent chapters as shown below:

Chapter 2: Literature review

This chapter presents a critical review of the current literature in the field of HIT in order to identify the gap in knowledge. Several theoretical frameworks and models were reviewed to understand the initiatives which have been developed towards the implementation of HIT in both developing and developed countries. Furthermore, through this chapter the first version of the Network of Influence Model (NIM) was developed with an illustration of its main categories and components.

Chapter 3: Research Methodology

This chapter provides a description to the research designed and the approach which have been used through this thesis. In addition, the research methodology have been outlined in this chapter, a mixed methods approach was used to investigate
implementation of IT projects in developing countries. This helped in providing answers to the research questions as well as to achieve the research aim and objectives. Moreover, reflecting on grounded theory and how it was used as a theoretical lens for collecting and analysing the data.

Chapter 4: The Libyan wounded personal in Greece case study

This chapter is a study that sought to reflect on the case of Libyans who sustained various forms of injuries during the 2011 uprising and were sent by the Libyan State to Greece for medical treatment.

Chapter 5: HIT in Libya with special focus on mHealth (Study 1)

This chapter reports on an empirical case study conducted in Libya to explore the challenges facing the adoption of HIT in healthcare organisations in Libya. It explores the opportunities that may assist healthcare providers and other stakeholders involved in healthcare delivery to benefit from the wide range of advantages m-Health can offer to enhance the delivery of the healthcare services.

Chapter 6: Exploring the critical success factors and the development of version 2 of the model (Study 2)

This chapter reports on the second study conducted to explore the critical success factors to implement HIT in developing countries. This chapter proposes the second version of the developed model with a comprehensive description of factors that constitute it.
Chapter 7: Validation of the research findings (Study 3)

This chapter presents how the findings of the research (the NIM) was validated using a modified Delphi study approach.

Chapter 8: Discussion and Conclusions

1.8 Conclusion

This chapter has introduced the thesis and the whole process of the research herein, including the literature review, methods used in the data collection, analysis and reflection on the overall methodology used. The eventual contributions to knowledge this thesis delivers are those outlined in 1.4.3 (Objectives).

This thesis has been limited by the lack of information that is available. Indeed, it has sometimes been difficult to persevere with the objectives drafted due to the current political instability within Libya, and the difficulty in putting together a model intended to operate within that country. However, the NIM produced does accurately combine a body of primary and secondary research into a logical form that can be tested and validated in future research and practice.
2 Literature Review

2.1 Introduction
The intent of this thesis is to construct an evidence-based, theoretical model for the successful implementation of Health Information Technology (HIT) systems in developing countries. The first stage was reviewing the relevant literature.

This chapter considers the factors reported in the literature with the potential to affect the implementation of HIT systems, analysing the diverse perspective of the many stakeholders involved in the delivery of healthcare services and IT solutions in developing countries context1.

The literature review is wide and comprehensive, and a very large number of articles were distilled and considered. The following section explains the methodology used and reports the results.

2.2 Methodology

2.2.1 Selection of the Literature
The guidelines proposed by Wahid (2012) were used to conduct this literature review. A structured review was conducted as suggested; the review was limited to retrieving and classifying the literature published between 2000 and 2013 discussing the numerous applications of HIT. HIT solutions were, of course, developed within this period, but were mostly in-house solutions; it was only the potential of the Internet (mid 2000) that gave rise to more patient-interactive HIT applications (Paré, Trudel, Jaana, & Kitsiou, 2014).

1 A version of this chapter was published in International Journal of Medical, Health, Biomedical and Pharmaceutical Engineering (Nakkas, Scott, & Briggs, 2015).
The technique for the process, synthesis and participation of the evidence were guided by (Lluch, 2011). This literature review chapter addresses the first three of the research questions, as shown in Table 2-1.

<table>
<thead>
<tr>
<th>Research question</th>
<th>Refer To</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1. What distinct factors should be taken into consideration when HIT projects are implemented in developing countries compared to developed countries?</td>
<td>2.3.1</td>
</tr>
<tr>
<td>RQ2. To what extent has HIT been deployed in developing countries?</td>
<td>2.3.2</td>
</tr>
<tr>
<td>RQ3. What factors influence the success/failure of the adoption of HIT in developing countries?</td>
<td>2.3.3</td>
</tr>
</tbody>
</table>

2.2.2 Data Sources and Search Strategy

Comprehensive searches were performed to identify the relevant literature. The source databases included PubMed, Google Scholar, IEEE, Science Direct and the Discovery tool at the University of Portsmouth Library.

In addition, a manual search was conducted across several journals specializing in health informatics. Search terms included the following keywords: critical success factors, health information technology, health informatics, developing countries, developing nations, emerging economy, theoretical frameworks. Only research which explicitly addressed HIT systems in the context of developing countries was included. Publication dates were limited to 2000-2017 with publication in the English language. For the PubMed search, publications in Arabic were also included but no studies were found. In addition, the results gathered were then “snowball-referenced”, a procedure that involves searching the references of each search result for additional relevant articles/publications.
The literature search was carried out in two stages. In the first stage, we used the above mentioned keywords during the search. In the second stage, we used a list of all the names of the countries in the following three categories: LICs, LMICs, and UMICs. The list was compiled with reference to the World Bank categorization. This stage ensured that all relevant e-Health studies were collected during this further stage. All countries’ names were listed in a query, followed by the application of HIT. From the first query, a number of studies related to developing countries appeared which did not appear in stage one of searching. In most cases, this was because the authors had used the name of the country in the title of the research paper, rather than categorizing it as an LIC, LMIC or UMIC.

Further keywords used to specify articles included HIT, developing countries, developed countries, success, exploring, failure, information technology, factors, EMRs, and personal medical records (PMRs).

2.2.3 Inclusion and Exclusion Criteria
The criteria for selecting the studies in the retrieval of the literature were as follows: the search was limited to journal articles and conference proceedings, excluding full journal papers which duplicated studies. Studies conducted in developed countries and studies that were solely concerned with technical aspects of HIT were excluded and used as background studies. Duplicate references were also excluded.

2.2.4 Methods of Analysis
The same approach used by Wahid (2012) was followed to select, classify and organize the literature. Content analysis was used in the analysis of the included literature and the following criteria were used to classify the literature:

Research methods and methods used for the data collection examined the previous research in terms of the methodologies used. Therefore, methods which this review found were classified as follows: (1) case study; (2) quantitative method; (3) qualitative
method; (4) mixed methods; (5) observation; (6) experimental study; (7) field study; and (8) other methods.

2.2.5 Overview of Methods / Data collection tools reported in the literature

Table 2-2 reports the number of studies adopting each of our methodology categories. Case study is the most common research method, followed by observation.

One of the findings of literature review is that a significant number of papers (47) have not explicitly identified the research method and data collection method they used. More studies preferred a quantitative rather than qualitative approach, while 12 studies out of 159 used a mixed methods approach.

<table>
<thead>
<tr>
<th>Research Method/Data Collection Tool</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case study</td>
<td>32</td>
</tr>
<tr>
<td>Quantitative</td>
<td>45</td>
</tr>
<tr>
<td>Qualitative</td>
<td>16</td>
</tr>
<tr>
<td>Mixed method</td>
<td>12</td>
</tr>
<tr>
<td>Observation</td>
<td>4</td>
</tr>
<tr>
<td>Experimental</td>
<td>2</td>
</tr>
<tr>
<td>Field study</td>
<td>1</td>
</tr>
<tr>
<td>Other methods</td>
<td>47</td>
</tr>
<tr>
<td><strong>Total 159</strong></td>
<td></td>
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</table>

2.2.6 Process of the structured literature review

The PRISMA approach was adopted for the literature review as depicted in Figure 2-1 (Moher, Liberati, Tetzlaff, & Altman, 2009). Stage 1 of the research yielded 1,319 articles. Of these, 1,287 articles were excluded based on title and abstract screening: 33
studies met the inclusion criteria. Stage 2 returned a total number of 1,362 studies. 700 articles were excluded based on title and abstract screening, leaving 662 articles. From these, 408 were excluded after reading abstracts, leaving 253 remaining that met the inclusion criteria.

The total number of articles which were considered to be directly relevant from both searches was 159, and these articles are the ones included in this research. A further 128 studies were also considered useful background as they were conducted in developing countries, and were linked to technical aspects of HIT and addressing HIT in general.

Figure 2-1 Process of the structured literature review and the sources of the literature

2.3 Results

Content analysis of the reviewed studies led to the identification of 26 factors that had an impact on the implementation of HIT in developing countries; some of these factors
can act as enablers and facilitators to implement HIT; and some of them can be considered as barriers that hinder the implementation of HIT (see Table 2-3).

It was revealed that the four most common factors were: costs (96 studies out of 159 studies), regulation (54/159) studies, ICT infrastructure (53/159), and Internet access (48/159). Whereas the factors that received the least attention were digital divide (3/159), political instability (2/159), and “brain drain” (only one study addressed this factor).

Application Type: The various applications of the HIT were also classified and grouped as follows: (a) Computerized Physician Order Entry (CPOE); (b) Decision Support Systems (DSS); (c) Electronic Medical Records (EMRs); (d) m-Health; (e) Picture Archiving and Communication System (PACS); (f) Personal Digital Assistant (PDAs); (g) telemedicine.

Table 2-3 Factors and their references in the literature

<table>
<thead>
<tr>
<th>Study</th>
<th>Factor</th>
<th>No of studies</th>
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<tbody>
<tr>
<td>1. (Allen et al., 2007; Andrade, Wangenheim, &amp; Bortoluzzi, 2003; Antohi, Ogescu, Bistriceanu, Stefan, &amp; Dumitru, 2008; Barbosa, de, &amp; de Vasconcelos, 2003; Baruah, 2005; Callaway et al., 2012; Chang et al., 2013; Chi et al., 2011; Dogac et al., 2011; Driessen et al., 2013; Feroze, 2008; Fraser, Blaya, Choi, Bonilla, &amp; Jazayeri, 2006; Fung &amp; Vogel, 2003; Ganapathy, 2002, 2004a, 2005; Gething et al., 2007; Hernandez-Avila et al., 2013; Hira et al., 2005; Holanda, do Carmo, Vieira, &amp; Catrib, 2012; Hsiao et al., 2006; Hussein &amp; Khalifa, 2012; Iwaya et al., 2013; Jazayeri et al., 2003; Kamadjeu, Tapang, &amp; Moluh, 2005; Karanja et al., 2011; Kazemi et al., 2009; Khan, Shahid, Hedstrom, &amp; Andersson, 2012; Kivuti-Bitok, McDonnell, Pokhariyal, &amp; Roudsari, 2012; Klinar, Balazin, Barsic, &amp; Tiljak, 2011; Li, Zhang, Chu,</td>
<td>Regulations</td>
<td>54</td>
</tr>
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2. (Chi et al., 2011; Mupela, Mustarde, & Jones, 2011).

<table>
<thead>
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<th>Political instability</th>
<th>2</th>
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<td>3. (Antohi et al., 2008; Baatar, Suldsuren, Bayanbileg, &amp; Seded, 2012; Baruah, 2005; Gething et al., 2007; Hannan et al., 2001; Holanda et al., 2012; Hsiao, Wu, &amp; Chen, 2013; Hussein &amp; Khalifa, 2012; Khan et al., 2012; Leon, Schneider, &amp; Daviaud, 2012; Lin et al., 2011; Mohan &amp; Razali Raja Yaacob, 2004; Odero, Rotich, Yiannoutsos, Ouna, &amp; Tierney, 2007; Rotich et al., 2003; Shiferaw &amp; Zolfo, 2012; Singh, 2005; Zafar et al., 2008).</td>
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<th>Policymakers</th>
<th>17</th>
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<td>4. (Allen et al., 2007; Allen et al., 2006; Baatar et al., 2012; Booman et al., 2003; Brandling-Bennett et al., 2005; Chang et al., 2013; Char, Kalyanpur, Puttanna Gowda, Bharathi, &amp; Singh, 2010; Chi et al., 2011; Cone, Hummel, Leon, &amp; Merrell, 2007; Deodhar, 2002; Feroze, 2008; Fraser et al., 2006; Ganapathy, 2002, 2004a, 2005; Garcia, Vargas, Caballero, Calle, &amp; Bayer, 2009; Geissbuhler, Ly, Lovis, &amp; L'Haire, 2003; Heinzelmann, Jacques, &amp; Kvedar, 2005;</td>
<td>Internet access</td>
</tr>
<tr>
<td>Studies</td>
<td>Category</td>
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<td>------------------------------------------------------------------------</td>
<td>---------------------------------</td>
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<tr>
<td>Hersh, Hersch, Mikuletic, &amp; Neilson, 2003; Hira et al., 2005; Holanda et al., 2012; Hsiao et al., 2006; Jankharia, 2001; Jazayeri et al., 2003; Kivuti-Bitok et al., 2012; Klinar et al., 2011; Levy, Blumberg, Kreiss, Ash, &amp; Merin, 2010; Lin et al., 2011; Martínez, Villarroel, Seoane, &amp; Pozo, 2004; A. I. Matheson et al., 2012; Misra et al., 2005; Mohan &amp; Razali Raja Yaacob, 2004; Ngabo et al., 2012; Ostojic et al., 2000; Pambudi, Hayasaka, Tsubota, Wada, &amp; Yamaguchi, 2004; Plaisanu, Niculae, Ogescu, &amp; Stefan, 2008; Saxena et al., 2003; Sek et al., 2007; Shiferaw &amp; Zolfo, 2012; Singh, Kapoor, Daman, &amp; Mishra, 2008; Sood &amp; Bhatia, 2005; Syed-Mohamad et al., 2010; Vassallo et al., 2001; Verma, Raman, &amp; Mohan, 2009; Wamala, Katamba, &amp; Dworak, 2011; Zachariah et al., 2012; Zhang et al., 2005; Zhao, Nakajima, &amp; Juzoji, 2002.</td>
<td>m-Health</td>
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<td>(Andrade et al., 2003; Au, 2012; Bali &amp; Singh, 2007; Booman et al., 2003; Brandling-Bennett et al., 2005; Callaway et al., 2012; Chang et al., 2013; Cone et al., 2007; Ganapathy, 2004a, 2005; Iwaya et al., 2013; John et al., 2012; Kapoor, Mishra, &amp; Singh, 2005; Karanja et al., 2011; Kivuti-Bitok et al., 2012; Lemay, Sullivan, Jumbe, &amp; Perry, 2012; Leon et al., 2012; Mahmud, Rodríguez, &amp; Nesbit, 2010; Martínez et al., 2004; Ngabo et al., 2012; Odigie et al., 2012; Oladosu &amp; Olamoyegun, 2012; Piette, Mendoza-Avelares, Milton, Lange, &amp; Fajardo, 2010; Prue et al., 2013; Shet &amp; de Costa, 2011; Suwamaru, 2012; Were et al., 2007).</td>
<td>Outage of power</td>
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<tr>
<td>7. (Allen et al., 2007; Booman et al., 2003; Callaway et al., 2012; Chi et al., 2011; Cone et al., 2007; Kamadjeu et al., 2005; Alastair I. Matheson et al., 2012; Ndira et al., 2008; Pambudi et al., 2004; Zhao et al., 2002).</td>
<td>Backups</td>
</tr>
<tr>
<td>8. (Allen et al., 2007; Amoroso, Akimana, Wise, &amp; Fraser, 2010; Anantraman et al., 2002; Anchala, Pant, Prabhakaran, &amp; Franco, 2012; Andrade et al., 2003; Au, 2012; Baatar et al., 2012; Bai, Murali, Kim, &amp; Srivatsa, 2007; Barbosa et al., 2003; Baruah, 2005; Bhatia &amp; Sharma, 2008; Brandling-Bennett et al., 2005; Chang et al., 2013; Char et al., 2010; Chi et al., 2011; Cone et al., 2007; Darkwa, 2000; Deodhar, 2002; Douglas, Deula, &amp; Connor, 2003; Driessen et al., 2013; Feroze, 2008; Fraser et al., 2006; Fung &amp; Vogel, 2003; Ganapathy, 2002, 2004a, 2004b, 2005; Gething et al., 2007; Guler &amp; Muldur, 2001; Heinzelmann et al., 2005; Hernandez-Avila et al., 2013; Hira et al., 2005; Holanda et al., 2012; Hsiao et al., 2013; Hunter &amp; Scott, 2010; Hussein &amp; Khalifa, 2012; Ikhu-Omoregbe, Ayo, &amp; Ehikiyoa, 2006; Jankharia, 2001; John et al., 2012; Kamadjeu et al., 2005; Kapoor et al., 2005; Kazemi et al., 2009; Kesavadev, Shankar, Pillai, Krishnan, &amp; Jothydev, 2012; Khan et al., 2012; Kifle, Payton, Mbarika, &amp; Meso, 2010; Kivuti-Bitok et al., 2012; Klinar et al., 2011; Kovai, Lonari, Paladino, &amp; Kern, 2000; Kvedar, Heinzelmann, &amp; Jacques, 2006; Lemay et al., 2012; Leon et al., 2012; Mahmud et al., 2010; Malaviya &amp; Gogia, 2010; Mars, 2010; Martínez et al., 2004; Alastair I.</td>
<td>Costs</td>
</tr>
</tbody>
</table>
Matheson et al., 2012; Meza et al., 2007; Misra et al., 2005; Mohan & Razali Raja Yaacob, 2004; Mrak, Paladino, Dzubur, & Desnica, 2009; Mupela et al., 2011; Ngabo et al., 2012; Sheraz F. Noormohammad et al., 2010; Odigie et al., 2012; Oladosu & Olamoyegun, 2012; Ostojic et al., 2000; Piette et al., 2010; Plaisanu et al., 2008; Pradeep et al., 2006; Pradeepa et al., 2011; Pruna et al., 2002; Rachapelle et al., 2013; Rotich et al., 2003; Seebregts et al., 2009; Seiwerth & Danilovic, 2000; Sek et al., 2007; Sharma & Rajput, 2009; Shet & de Costa, 2011; Shiferaw & Zolfo, 2012; Siika et al., 2005; Singh, 2005; Sood & Bhatia, 2005; Sorensen, Rivett, & Fortuin, 2008; Thara et al., 2008; Tierney et al., 2007; W. M. Tierney et al., 2002; Top & Gider, 2012; Vassallo et al., 2001; Verma et al., 2009; Vuletic, 2001; Were et al., 2007; Were et al., 2010; Xue et al., 2012; Zachariah et al., 2012; Zafar et al., 2008; Zhang et al., 2005).

9. (Anantraman et al., 2002; Bali & Singh, 2007; Barbosa et al., 2003; Baruah, 2005; Bhatia & Sharma, 2006; Chang et al., 2013; de la Cruz, Lopez, Uribe, Gonzalez, & Blobel, 2011; Hernandez-Avila et al., 2013; Hersh et al., 2003; Hira et al., 2005; Holanda et al., 2012; Hsiao et al., 2013; Hunter & Scott, 2010; Jankharia, 2001; Kamadjeu et al., 2005; Khan et al., 2012; Kifle et al., 2010; Lewis, Douglas, Monaco, & Crowley, 2010; Li et al., 2012; Lin, Lin, & Roan, 2012; A. I. Matheson et al., 2012; Mezni & Zeribi-Benslimane, 2008; Mohan & Razali Raja Yaacob, 2004; Ndira et al., 2008; S. F. Noormohammad et al., 2010; Oladosu & Olamoyegun, 2012; Pambudi et al., 2004; Pradeepa et al., 2011; Sambasivan et al., 2012; Singh et al., 2008; Syed-Mohamad et al., 2010; Top & Gider, 2012; Zachariah et al., 2012).
| 10 | (Hira et al., 2005; Hussein & Khalifa, 2012; Khan et al., 2012; Pradeepa et al., 2011; Jeremiah Scholl, Shabbir Syed-Abdul, & Luai Awad Ahmed, 2011b). | Resistance to change | 5 |
| 11 | (Allen et al., 2007; Allen et al., 2006; Anantraman et al., 2002; Bennani Othmani, Diouny, & Boumalif, 2012; Chang et al., 2013; Driessen et al., 2013; Karanja et al., 2011; Malaviya & Gogia, 2010; Alastair I. Matheson et al., 2012; Monda, Keipeer, & Were, 2012; Ngabo et al., 2012; S. F. Noormohammad et al., 2010; Pambudi et al., 2004; Seebregts et al., 2009; Syed-Mohamad et al., 2010; William M Tierney et al., 2002; Were et al., 2007). | Open source software | 17 |
| 12 | (Fraser et al., 2006; Hussein & Khalifa, 2012; Mohan & Razali Raja Yaacob, 2004; Plaisanu et al., 2008; Shiferaw & Zolfo, 2012; Thara et al., 2008; Tierney et al., 2007). | Academia | 7 |
| 13 | (Au, 2012; Baatar et al., 2012; Hsiao et al., 2013; Ikhu-Omoregbe et al., 2006; John et al., 2012; Kapoor et al., 2005; Kinar et al., 2011; Lin et al., 2012; Meher, Tyagi, & Chaudhry, 2009; Mohan & Razali Raja Yaacob, 2004; Mohan et al., 2012; Pradeepa et al., 2011; Prue et al., 2013; Thara et al., 2008). | Awareness | 14 |
| 14 | (Baatar et al., 2012; Bhatia & Sharma, 2006; Driessen et al., 2013; Ganapathy, 2005; Guler & Muldur, 2001; Hannan et al., 2001; Hernandez-Avila et al., 2013; Hira et al., 2005; Hsiao et al., 2013; Jankharia, 2001; Khan et al., 2012; Kifle et al., 2010; Kivuti-Bitok et al., 2012; Martínez et al., 2004; A. I. Matheson et al., 2012; Mengiste, 2010; Mohan & Razali Raja Yaacob, 2004; Mupela et al., 2011; Odero et al., 2007; Pradeepa et al., 2011; Jeremiah Scholl et al., 2011b; Shiferaw & Zolfo, 2012). | IT skills | 22 |
(Baatar et al., 2012; Barbosa et al., 2003; Bhatia & Sharma, 2006; Brandling-Bennett et al., 2005; Chi et al., 2011; Douglas et al., 2003; Driessen et al., 2013; Fraser et al., 2006; Fung & Vogel, 2003; Garcia et al., 2009; Leon et al., 2012; Alastair I. Matheson et al., 2012; Mohan & Razali Raja Yaacob, 2004; Mohan et al., 2012; Mupela et al., 2011; Ngabo et al., 2012; Pambudi et al., 2004; Plaisanu et al., 2008; Pradeepa et al., 2011; Rotich et al., 2003; Seebregts et al., 2009; Shiferaw & Zolfo, 2012; Suwamaru, 2012; Tierney et al., 2007).

(Darkwa, 2000; Hsiao et al., 2013; Leon et al., 2012; Lin et al., 2012; Mohan & Razali Raja Yaacob, 2004; Ndira et al., 2008; Odero et al., 2007; Plaisanu et al., 2008; Jeremiah Scholl, Shabbir Syed-Abdul, & Luai Awad Ahmed, 2011a; Thara et al., 2008; Ting et al., 2011).

(Allen et al., 2006; Bai et al., 2007; Baruah, 2005; Booman et al., 2003; Callaway et al., 2012; Chi et al., 2011; Darkwa, 2000; Douglas et al., 2003; Driessen et al., 2013; Feroze, 2008; Fraser et al., 2006; Ganapathy, 2002, 2004a, 2005; Geissbuhler et al., 2003; Gething et al., 2007; Hannan et al., 2001; Hernandez-Avila et al., 2013; Hussein & Khalifa, 2012; Jankharia, 2001; Jirapaet, 2001; Kapoor et al., 2005; Khan et al., 2012; Kifle et al., 2010; Kivuti-Bitok et al., 2012; Kovai et al., 2000; Kvedar et al., 2006; Leon et al., 2012; Mars, 2010; Martínez et al., 2004; Alastair I. Matheson et al., 2012; Mengiste, 2010; Misra et al., 2005; Mohan & Razali Raja Yaacob, 2004; Mohan et al., 2012; Mupela et al., 2011; Ngabo et al., 2012; Sheraz F. Noormohammad et al., 2010; Odero et al., 2007; Odigie et al., 2012; Pambudi et al., 2004; Pradeepa et al., 2011; Seiwerth & Danilovic, 2000; Sek et al., 2004; Suwamaru, 2012; Tierney et al., 2007).
| 2007; Shet & de Costa, 2011; Shiferaw & Zolfo, 2012; Singh et al., 2008; Singh, 2005; Sood & Bhatia, 2005; Thara et al., 2008; Tierney et al., 2007; Ting et al., 2011; Zhao et al., 2002). | Cultural and social barriers | 16 |
| (Booman et al., 2003; Geissbuhler et al., 2003; Hira et al., 2005; Hunter & Scott, 2010; Hussein & Khalifa, 2012; Kamadjeu et al., 2005; Kazemi et al., 2009; Khan et al., 2012; Kifle et al., 2010; Leon et al., 2012; Ndira et al., 2008; Odero et al., 2007; Singh, 2005; W. M. Tierney et al., 2002; Ting et al., 2011; Zachariah et al., 2012). | Infrastructural factors | 11 |
| (Bai et al., 2007; Heinzelmann et al., 2005; Leon et al., 2012; Martinez et al., 2004; Mohan et al., 2012; Mrak et al., 2009; Mupela et al., 2011; Pambudi et al., 2004; Piette et al., 2010; Siika et al., 2005; Singh, 2005). | Training | 39 |
| (Allen et al., 2006; Anantraman et al., 2002; Brandling-Bennett et al., 2005; Char et al., 2010; Cone et al., 2007; Doarn, Adilova, & Lam, 2005; Driessen et al., 2013; Fraser et al., 2006; Fung & Vogel, 2003; Ganapathy, 2004a; Hannan et al., 2001; Hernandez-Avila et al., 2013; Hsiao et al., 2013; Jankharia, 2001; Kapoor et al., 2005; Lemay et al., 2012; Leon et al., 2012; Malaviya & Gogia, 2010; Mohan & Razali Raja Yaacob, 2004; Mohan et al., 2012; Ngabo et al., 2012; Sheraz F. Noormohammad et al., 2010; Odero et al., 2007; Pradeepa et al., 2011; Prue et al., 2013; Pruna et al., 2002; Sambasivan et al., 2012; Seebregts et al., 2009; Shiferaw & Zolfo, 2012; Singh, 2005; Sood & Bhatia, 2005; Syed-Mohamad et al., 2010; Thara et al., 2008; Tierney et al., 2007; Ting et al., 2011; Top & Gider, 2012; Vassallo et al., 2001; Zachariah et al., 2012; Zafar et al., 2008). |
2.3.1 RQ 1: The distinct factors for developing countries

Brain drain and language barriers are just two of the factors that significantly impact the ability of the roll-out of a system (considered a success in one country) and failure in another. These factors also affect “out-of-the-box” software (i.e. database systems designed in English) as well as customised HIT. Some of the other factors, solely related to developing countries, are shown in Figure 2-2.
2.3.2 RQ 2: The Implementation of HIT In Developing Countries

Table 2-4 lists the 42 countries reported in the literature as having evidence of the deployment of HIT, together with the number of studies relating to that country. While there is increasing adoption of HIT systems in developing countries, the level of implementation differs from country to another. The majority of the studies were conducted in Asia, with India conducting 41 studies. The cells highlighted in yellow illustrates the countries where there are more than 9 studies conducted.
<table>
<thead>
<tr>
<th>Country name</th>
<th># Studies</th>
<th>Country Name</th>
<th># Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>3</td>
<td>Mali</td>
<td>1</td>
</tr>
<tr>
<td>Bhutan</td>
<td>1</td>
<td>Mongolia</td>
<td>1</td>
</tr>
<tr>
<td>Brazil</td>
<td>9</td>
<td>Morocco</td>
<td>1</td>
</tr>
<tr>
<td>Cambodia</td>
<td>5</td>
<td>Mexico</td>
<td>2</td>
</tr>
<tr>
<td>Cameroon</td>
<td>1</td>
<td>Nigeria</td>
<td>3</td>
</tr>
<tr>
<td>China</td>
<td>10</td>
<td>Papua New Guinea</td>
<td>2</td>
</tr>
<tr>
<td>Colombia</td>
<td>1</td>
<td>Peru</td>
<td>3</td>
</tr>
<tr>
<td>Croatia</td>
<td>7</td>
<td>Romania</td>
<td>3</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1</td>
<td>Rwanda</td>
<td>4</td>
</tr>
<tr>
<td>Egypt</td>
<td>1</td>
<td>Slovenia</td>
<td>1</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2</td>
<td>Somalia</td>
<td>1</td>
</tr>
<tr>
<td>Haiti</td>
<td>4</td>
<td>South Africa</td>
<td>5</td>
</tr>
<tr>
<td>Honduras</td>
<td>1</td>
<td>Tanzania</td>
<td>1</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>3</td>
<td>Thailand</td>
<td>1</td>
</tr>
<tr>
<td>India</td>
<td>41</td>
<td>Tunisia</td>
<td>1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1</td>
<td>Turkey</td>
<td>4</td>
</tr>
<tr>
<td>Iran</td>
<td>1</td>
<td>Uganda</td>
<td>4</td>
</tr>
<tr>
<td>Kenya</td>
<td>14</td>
<td>Uzbekistan</td>
<td>1</td>
</tr>
<tr>
<td>Malawi</td>
<td>5</td>
<td>Vietnam</td>
<td>1</td>
</tr>
<tr>
<td>Malaysia</td>
<td>3</td>
<td>Zambia</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total number of studies</td>
<td>159</td>
</tr>
</tbody>
</table>

Furthermore, several studies considered the differences between developing and developed countries. These differences indicated that the implementation of HIT in less developed nations progressed more slowly when compared to the developed nations because it encountered multiple and complex barriers and challenges.

Although some of these barriers are also faced by the developed countries, the ability of these countries to address these challenges is far ahead of developing countries’ abilities. This is due to several factors. For example: IT infrastructure, Internet speed, investing heavily in building large national IT systems and IT skills. That is why some developing countries are taking the lead in the implementation of HIT systems.
Identifying and overcoming these barriers for developing countries is not always straightforward given the fact that the majority of the published literature about HIT strategies is based on experiences from developed countries, which may not be directly applicable to developing countries.

A total of 41 studies were found and Figure 2-3 shows that most of the studies identified addressed HIT in Indian projects, and that most were concerned with telemedicine. There are 97 countries where no studies have been conducted.

Figure 2-3 The various applications of HIT in India

Table 2-5 shows the number of studies broken down by development category. The number of countries designated by the World Bank as being in that category is also provided for reference.
<table>
<thead>
<tr>
<th>Category</th>
<th># Studies</th>
<th># Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>LICs</td>
<td>46</td>
<td>36</td>
</tr>
<tr>
<td>LMICs</td>
<td>68</td>
<td>48</td>
</tr>
<tr>
<td>UMICs</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>159</strong></td>
<td><strong>139</strong></td>
</tr>
</tbody>
</table>

The findings of the literature review indicate a notable lack of empirical studies that illustrate the current status of HIT in developing countries. This lack is most pronounced in the Middle East and North Africa (see Figure 2-4).

Very little was found in the literature about the use of HIT in certain countries and certain regions of the world. The focus of our thesis will be on the countries situated in North Africa, particularly Libya. Although, this was a prior decision, which is justified by the knowledge gap in the literature. Only one study was found on each of CPOE, PACS and PDAs in the UMICs. (See Figure 2-5)
For some application types, no studies have been found at all. Further academic research could investigate whether this is because these types of systems are not being implemented in developing countries, or whether they are implemented but simply not written about in sources accessible to us.

Figure 2-5 The various application of HIT in developing countries.

2.3.3 RQ 3: Factors Influencing the Success/Failure of Health Information Systems in developing countries

This section reports on the success and barriers which seem to influence the implementation of HIT in developing countries which have been addressed in the literature in attempt to answer question 3 of this thesis.

RQ3. What factors influence the success/failure of the adoption of HIT in developing countries?

In attempting to answer this, a structured literature review approach was used. The following 29 factors emerged, grouped them into nine main themes.
2.4 Discussion of RQ 1

Overall, the results of this literature review revealed HIT has been implemented in developing countries to varying degrees over the past decade and a half. HIT is an issue which is under-researched in some developing countries; this includes countries in the Middle East and North Africa.

We can see from the Table 2-2 that the first factor which has been ignored in the HIT literature is brain drain, and specifically the impact this can have on the overall economic development on the developing nations. Second in the list is the political instability, which also was not given enough attention in the literature; we believe it has a profound
impact on the success of the HIT systems in developing countries. In addition, digital
divide is one of the factors which have been under reported in the literature.

The following section of this chapter addresses some theoretical frameworks and
models which were developed to help in understanding the adoption of HIT systems in
the context of developing countries.
2.4.1 Models of Health Information Systems in developed countries

The following sections address some of the models of Health information Technology in developed countries.

2.4.1.1 The ITPOSMO Dimensions of Health Information System Design – Reality Gaps

The ITPOSMO model was developed to address the chronic problems of failure in IT systems in healthcare (See Figure 2-7). Mainly the model can be used as tool to assess the implementation of HIT projects before and after the intervention to understand how HIT systems can be implemented successfully and mitigate the risk of failure. At first sight it appears somewhat rudimentary but it correctly identifies the dimensions that are impacted by any system roll-out. The intention is for it to be used in combination with interviews with stakeholders, focused on the specific dimensions covered. The “Gap” will reveal the shortcomings, if any.

This model has been referenced frequently by several researchers as it provides a very simple, abstract analysis for researchers and policymakers to address any gaps that may exist.
Yusof, Kuljis, Papazafeiropoulou, and Stergioulas (2008) have developed the Human-Organisational-Technology Fit Model, also designed to evaluate studies on IS. As shown in Figure 2-8, the framework addresses technological, human, and organisational factors. Furthermore, the authors argue that throughout all the development stages of any HIT project including planning, analysis, design, implementation, operation, and maintenance, a critical evaluation of human, organisational, technological factors needs to be addressed.
2.4.1.3 The Contextual Implementation Model (CIM)

The Contextual Implementation Model (Callen, Braithwaite, & Westbrook, 2008) attempts to address the disparity of perception (as to whether a project succeeded or failed) by defining the interrelationships and impact of the professional groups involved in its implementation (See Figure 2-9).

Additionally, the authors propose three key levels, which they categorise as the organisational context, clinical unit or individual context. The three levels cover sociotechnical factors, providing an illustration of the complexity of implementing HIT systems.
2.4.2 Models of Health Information Systems in Developing Countries

Although there have been a considerable number of HIT systems implemented in developing countries, a smaller number of models and theoretical frameworks have been developed to address the issues of implementing them. The following section reviews some of them in an attempt to evaluate their strengths, and suggests areas for improvement. These models have been instrumental in the design of the proposed theoretical framework set out in Section 3.10 (below).

2.4.3 Technology Acceptance Model (TAM)

Ahlan and Ahmad (2015) attempted to address the success or failure of ICT systems by devising the Technology Acceptance Model (TAM) (See Figure 2-10). The model places the evaluation of the ICT system at its heart, and addresses each of the factors that impact whether or not it is accepted by the end users. The model is useful as it addresses
stakeholder perception and involvement in developing a project. However, I would argue that it is difficult to strictly apply it to HIT. This is not because the model has no application at all. Rather it is because the end-users envisaged by the model are clearly those who are familiar with all aspects of the system’s design and cost-effectiveness.

In the case of HITs, the end users would therefore be the medical professionals. The model is silent in regard to the healthcare patients themselves; their perceptions and involvement in the HIT would not be considered, and they would not be in possession of some of the information which would impact upon the evaluation of success or failure.

2.4.4 Description of Gaps in the Literature

A critical analysis of the literature has identified the following gaps:

1. There is a lack of academic evidence of HIT implementation in North African countries in general, and in relation to Libya in particular. The literature which does exist shows the failure rate of HIT projects is quite high, which could lead to significant loss of money within healthcare. End users, the physicians and managers may not therefore derive any benefit from any HIT project as a result.

2. No research has been conducted that addresses HIT from the perspective of all the different stakeholders, e.g. Ministry of Health (MoH), practitioners, IT providers, international development agencies. In relation to developing countries, the studies are often limited to the perspective of one stakeholder. It is important to consider that “success” means different things to different stakeholders.

3. There is a lack of research concerning the validation of some information system. For example, the Technology Acceptance Model (TAM) in HIT in the context of developing countries.
2.4.5 HIT Promises and Challenges

From the literature reviewed, some common themes can be identified. The first is the “promise” of HIT (i.e. its perceived benefits). The second, the challenges that implementing HIT brings.

HIT has the potential to improve the quality of healthcare and reduce costs (Luna et al., 2013; Salzberg et al., 2012; Wickramasinghe & Schaffer, 2009; Wu et al., 2006) and the maturity of some Open Source Medical Records systems means that a stable and reliable system can be used as foundation (Fraser et al., 2012).

HIT includes is but not limited to:

- Helping to manage chronic diseases
- Decision Support Systems helping to provide advice and guidance
- Alerts for abnormal results
- Supporting clinical research

Because HIT is considered a multi-disciplinary field (Friedman, 2006), its evaluation can be complex (Scott & Briggs, 2009).

At time of writing, the most recent overarching study into HIT projects is that conducted by (Luna et al., 2013). The scope of this thesis is significantly wider because it considered 159 studies addressing HIT in the context of developing countries by using a wider choice of keywords in its initial keyword search. It is notable that the search has not, however, yielded any evidence of research conducted in Libya, an UMIC, whilst in India (a LMIC) at least 41 studies were discovered. Some research into Libyan IT projects, and their failure rate, is urgently required.

As an aside, one reason for the difference may well be that LMICs receive funds from international bodies designed to combat pandemics and diseases; some countries adhere to stricter compliance legislation than others meaning that the research conducted is more widely available.
Although these differences in the number of studies found between countries is significantly vary, the empirical literature aimed at identifying the causes is limited. Factors which might have contributed to this are: country population density, wealth, and geographical dispersion.

2.5 Barriers and Enablers Influencing Implementation of HIT in Developing Countries

In relation to developing countries, certain academics have carried out research that suggests that the successful implementation of ICT projects is impacted by bespoke factors that must be identified in relation to the target country (Al-Mabrouk & Soar, 2009; J. Scholl, S. Syed-Abdul, & L. A. Ahmed, 2011).

2.5.1 Brain Drain

Put at its most simple, developing countries often lack the professional and educated programmers that modern ICT projects demand. This is because such people, if they are able, leave developing countries for developed ones, where they can earn more money or enjoy a better quality of life. This factor is referred to, in the vernacular, as “brain drain”.

2.5.2 Language Barriers

This barrier is also surprisingly absent from the studies referred to in the literature. The primary language of ICT is English (followed by Chinese and Japanese and then the major European languages) and all computer code uses pseudo-English commands to achieve its purpose. What makes for simple-to-understand concepts for an English IT professional (parent, inheritance, interface, etc) is, on its face, incomprehensible to a speaker of, for example, an Arabic language. Instead, the word must be translated to its Arabic equivalent and its use and implementation understood, even when the translated word does not precisely match the English one.
The language barrier is also a significant obstruction to re-using an ICT project considered successful in one country in another. It is not difficult to see the difficulty in relation to healthcare workers (or indeed patients) struggling to interact with systems that are not in their native language.

2.5.3 HIT and The Missing Evidence
Anecdotal evidence suggests that ICT is used in many more healthcare organisations in developing countries than those for which studies have been published (and found). Any documentation on these "missing" projects remains unknown and/or ignored. Hence, if the ICT solution failed, the organisation may attempt it again and previous research shows that organisational memories of that failure are usually not retained, leading to a vicious cycle of failure (Özdemir, 2010). Furthermore, where academic literature does exist, it is sometimes of low quality and submitted for research counting exercises rather than to disseminate and share knowledge (Scott, Prytherch, & Briggs, 2010).

The literature search conducted did not retrieve any literature pertinent to HIT in Libya, so a manual search was conducted upon the same databases to find the prevalence of Information Technology in other sectors of the economy (e.g. energy, education and banking). A combination of the following keywords in the search were used: e-Learning, e-Banking, IT - ICT adoption. This search yielded seven studies. It is interesting to note that six of these studies concerned the use of IT in the educational sector, including one study that spanned education, banking and oil. This does not mean that IT has not been used in other sectors of the economy in Libya, but there is none available to us. For all we know, there is a filing cabinet somewhere in Libya full of evidence.

2.6 HIT and National Context
It can (and indeed has) be argued that developing countries do not always need to “reinvent the wheel” in order to implement HIT solutions, and that they could export HIT software from developed countries (Heeks, 2003) or use Open Source solutions (Fraser et al., 2012). Wickramasinghe and Schaffer (2009) suggested that, if doing so, the following four prerequisite key steps need to be addressed:
1. ICT architecture and infrastructure;
2. Standardisation policies, protocols and procedures;
3. User access and accessibility policies and infrastructure; and
4. Governmental regulation and control.

It is crucial for Libya to consider possible barriers and take the necessary precautions before attempting to implement any HIT solutions.

It is arguable that sustainable HIT can only be maintained if any barriers are successfully considered before any implementation. These barriers can range from the obvious (lack of ability to recover a lost password; see (Agoro, Kibira, Freeman, & Fraser, 2017) to the complex interplay of technical, contextual, financial, academic and social-technical issues (Table 2-3). Similar challenges to HIT initiatives are found both in developing countries and developed countries, but there are unique demands for the developing countries which need to be addressed differently along with the factors (Table 2-3).

Furthermore, each country requires the implementation of HIT to be tweaked to cope with the local requirements. Each country has its own particular political, economic and social dimensions (drivers or constraints) that might influence the development of good practice of HIT initiatives.

There have been considerable efforts by researchers in the literature to address the implementation of HIT projects and the challenges they face. However, the vast majority of the theoretical frameworks and models in the literature are conducted and discussed in the context of developed countries.

There is evidence in the literature that HIT can help to enhance the healthcare delivery in limited resources settings. Many researchers, policymakers, and healthcare providers in developing countries have proffered initiatives as to how these countries can benefit from the advantages HIT can offer, in order to bring the standard of healthcare up to those of the developed countries.
There is, therefore, the necessity to develop a conceptual theoretical model which takes into the account the gap between developing and developing countries and the special contextual requirements of the latter. The models and frameworks which are tested and developed to help implement HIT systems in the developed countries might not be directly practical to developing countries.

2.7 The Proposed Conceptual Theoretical Framework

The common sense position is that properly-managed ICT will improve healthcare in developing countries, and there is no reason to deviate from this starting point. Unfortunately, and somewhat alarmingly, the rates of failure in the studies considered are high. As many of these studies are concerned with developed countries, and bearing in mind the plethora of additional factors that need to be considered in their regard, what is required is a Conceptual Theory Framework (CTF) which identifies, broadly, the factors which will be enablers and the factors which will be hinderers. The model can be influenced, if appropriate, by the previous HIT research which was highlighted earlier.

Theoretical models and frameworks have numerous uses. They can enable us to categorise and represent different components of a phenomenon in a structured and hopefully simplified illustration. Moreover, they can help us in explaining, prioritizing, and understanding problems which often have different dimensions.

Theoretical approaches are often used to achieve three broad goals:

1. to illustrate and/or guiding how research can be applied into practice (also known as process modelling),

2. to explain and/or understand what the factors are which affect the outcomes of the implementation (This can fall under one of the categories: determinant frameworks, classic theories or implementation theories), and

3. to assess the implementation (also known as evaluation frameworks) (Agoro et al., 2017; Nilsen, 2015).
The following model is the culmination of the research and, it is suggested, a model which can assist the reader in assessing why and how any HIT project will succeed or fail in a developing country. The model can be used to achieve a more evidence-based practice. It has been entitled the Network of Influence model and it is shown in Figure 2-11. It illustrates the factors that may facilitate or hinder the implementation of HIT in a developing country.
Figure 2-11 Network of Influence Model identifying the factors that influence HIT adoption
Figure 2-11 is actually the first version of the NIM (It is further revised in Chapter 5, below). It was developed to capture the factors which may influence the implementation of HIT. The preceding sections have introduced some of the research that has gone into its development.

e-Health implementation is not all about technology; there are other factors which have to be addressed in order to realise full potential IT offers in the delivery of healthcare services. According to (Baxter & Sommerville, 2011), these factors can be conveniently grouped together as “socio-technical factors”. Socio-technical merges human, social and organisational factors. These factors should be considered alongside the organisational context (Baxter & Sommerville, 2011).

Most of the prior models and frameworks only address a particular domain and do not consider other domains that are connected to it.

The NIM not only exhaustively illustrates the factors which may influence the adoption process of HIT, it attempts to explain how such factors are related to each other, and categorises the factors themselves into groups. Furthermore, it is the interoperability of the factors that illustrates the challenge of implementing HIT in developing countries. The whole is greater than the sum of its parts; elements of the NIM cannot be extracted and viewed in isolation. The complexity of the interoperability is also obvious from the NIM itself. It consists of nine categories which are its key components. These categories are infrastructure, cultural, human, organisational, financial, trust, legislation, political, and academia. These categories are linked to the sub factors and how they influence or influenced by other factors, all of which are discussed in much more detail in the following sections.

2.8 The Components of the Model

2.8.1 Technological infrastructure

Technological infrastructure includes the physical network of cables, phone lines, servers and terminals. No HIT project will succeed without a good technological
infrastructure, and providing this solid foundation can be particularly challenging in those developing countries where the IT infrastructure is very weak.

The infrastructure may also be dependent upon telecommunications, electricity (the supply of which may be unreliable), access to computers and access to Internet services. Whilst some studies (Agoro et al., 2017) have concluded that unreliable electricity did not act as a barrier, it is common sense that managing the risk of power outages within any proposed ICT is one of the important factors in ensuring the HIT implementation is successful.

As an obvious example, do not house the physical servers, databases and systems in a location which is near to a disputed border (risk of destruction) or in a location which suffers power-cuts, no matter how infrequent. Instead, place them in a safe location; if no safe location exists within the developing country, create one or use a safe location in a neighbouring country for the infrastructure. If no safe location can be identified at all, recognise that the ICT implementation will be doomed from the outset, and divert the resources into creating the safe location before commencing the project.

In many developing countries, the land is, by its very nature, not developed. Cities are often located far away from each other and are separated by swathes of rural areas. People may need to travel many miles to the surgery of the nearest doctor. However, with m-Health services implemented, people may well be able to use a mobile phone to connect to a HIT solution. Although it does not fix the problem of poor people needing desperate medical attention, it does allow remote consultation, reminders and, indeed, data-collecting in areas which hitherto would be ignored. To take an obvious example, m-Health solutions which monitor smokers’ blood-nicotine content have been proven to lead to reduced levels of smoking (Piette et al., 2012) and more sophisticated systems may well be able to diagnose serious illnesses from a patient’s complaints and advise medical attention where, without such a system, the patient may not seek it.

The ‘digital divide’, for the purposes of the NIM, refers to the gap between those countries using the latest technology and those countries that are not. Most countries are now at least connected to the Internet, but in some developing countries the connection is still made by dial-up technology and access may therefore take some time.
This ‘digital divide’ is important to consider in relation to ICT and encompasses aspects which may not at first be readily apparent. For example, the connection may not just be slow; it may also be that many of the computers that will ultimately be used to access the product may be old, and may be running software which is no longer supported. They may also be running proprietary or illegal software. In the case of the latter, they may be malware-infected. This factor is very pronounced between developed and developing countries.

2.8.2 Cultural Factors

Cultural factors include language, corruption and resistance to change. Several studies have addressed what role cultural norms can play in the adoption of ICT. In relation to healthcare, every country has its own set of norms and traditions, methods of payment and expectations in relation to healthcare services. However, the adoption or introduction of new HIT may impact upon how people have traditionally performed a particular task. One simple demonstration of this is changing from a manual, paper-based system to a computerised system can be challenging.

The fact that people are sometimes resistant to the change itself needs to be taken into account and addressed carefully. Furthermore, different countries speak different languages and in some countries, more than one language is spoken. Therefore, HIT systems need to be developed and offered in many different languages. This is one example where off-the-shelf HIT systems are not always an optimal solution. A further factor which needs to be taken into account is financial corruption, which sadly is often a symptom in developing countries. Needless to say, if any ICT project is infected with corruption, the product which emerges from it is unlikely to be of much use at all.

Sadly, in practical terms, many of these important factors are rarely considered at all when implementing a HIT product, as it has been discussed in the literature review chapter. Instead, the technology alone is considered to be the product, the product is started and only, as the product reaches a stage of some maturity, is it introduced to the different stakeholders for their consideration and assessment. Many ICT projects fail for precisely this reason; the delayed consultation with stakeholders means that it is only at this late stage that the impact the ICT will have is assessed. Stakeholders then point out
the many changes to their relationships that will occur as a result of its roll-out, and quite possibly that these changes will be less desirable than continuing with things as they are. In relation to HIT, for example, any ICT software which impacted upon the cultural norms of patients, communities and care providers would really need a detailed, up-front study of the desirability of changing those cultural norms before a single line of code was written.

2.8.3 Human Factors

Some of the human factors, such as brain drain, have already been extensively covered by this chapter. But other human factors exist, which are of equal importance for the adoption of HIT. As is to be expected, studies in the literature review have examined the role played by people themselves, in particular their awareness of the project, their IT skills and whether or not they receive hands-on training to use the HIT solution ultimately developed.

Governments, policymakers, funders and healthcare providers need to invest in people and nurture their capacities over their working lives. Technology never stands still, and, without constant maintenance, a system designed today may well be nearly obsolete within ten years. It is not possible to invest in the technology alone. The people using it must be constantly trained, taught new skills, corrected if they are using the HIT improperly (or indeed, just “differently” as to how it was intended) and encouraged to report any additional uses to which the technology might be put.

It is also worth adding a proviso that the human factors may also touch upon both the legal and academic ones, which are explained below.

2.8.4 Organisational Factors

Healthcare organisations, be they hospitals, surgeries or mental institutions, are, by their very nature, complex (Burns, Bradley, & Weiner, 2011). These organisations are also charged with delivering any HIT services but, of course, the provision of the HIT
services are secondary to the delivery of the healthcare itself (Hammer & Champy, 2009).

Individual healthcare organisations do not exist in a vacuum – they are parts of a network of services, each of which make referrals and depend upon the others within it. For example a hospital is an organisation which is made up of a group of stakeholders who work together for a shared goal. These stakeholders can be healthcare providers (doctors, nurses, clinicians), services delivery supporters (administrators, finance, IT, human resources), government bodies, suppliers of various services, and others (Burns et al., 2011).

Our literature review has revealed four sub-factors related to these organisational factors. These are: workforce capacity, change management, leadership and organisational management. Organisations need to invest heavily in their people by providing training to their staff, particularly in relation to liaison between staff and IT professionals, to equip them with the required skills.

2.8.5 Financial Factors
Common to ICT success or failure in both developed and developing countries is the financial factor. Put simply, funding needs to be available, both for construction of the ICT solution, and for its maintenance, for it to continue operating successfully. The financial factor connects to most of the other components of the NIM, and has the heaviest influence upon them.

2.8.6 Legal Factors
Whenever an ICT solution deals with a person’s personal data, there is bound to be some storing of that data for future recall. In developed countries, what can be done with data may be prescribed by law. In developing countries, it is less likely that legislation exists in relation to data but certain common-sense safeguards may be built into any ICT solution and these safeguards may ultimately have the same effect as legislation. For example, it would not be considered desirable for a secretary scheduling patients’
appointments to have access to the patients’ full medical history, so well-designed software would prevent the secretary from seeing it.

Occasionally however, a developing country may have laws in place that impact upon the ICT solution itself. For example, consider a country where a law exists that healthcare will only be provided to a citizen who presents his insurance documents, which must then be confirmed as valid, on each visit to a hospital. If such arbitrary laws are in place, they will very likely be common knowledge to that country’s citizens, but may be completely disregarded in the requirements of the HIT itself if no thorough understanding of them exists. That thorough understanding of what actually happens on the hospital premises may only be able to be provided by certain stakeholders.

In such a case, the situation may be further compounded if the HIT does not validate that such documents were provided, with a valid legal argument then existing that the HIT has introduced an illegal system. Even if such arbitrary laws do not exist when the system is designed, they may be enacted afterwards, necessitating immediate change. Put simply, the stakeholders responsible for triggering that change must therefore be identified to prevent project failure.

It is beyond the scope of this research to continue this point in full, but it can be certainly be easily understood that the data stored within HIT solutions is of the most sensitive type. If a developing country has no laws to protect, for example, the exposure of patients’ infections, susceptibility to illness, scarring, mental health issues, etc - and those implementing the HIT system are simply not trained to secure such data, then the e-Health technology may well be creating many more problems than it solves.

2.8.7 Academia

Academic institutions also play their own part in enhancing the delivery of healthcare systems. This can be achieved through development of training courses or through creating a research culture (Mohan & Yaacob, 2004).
2.9 Conclusion

This literature review was undertaken to answer the following three research questions:

RQ1. To what extent has HIT been deployed in developing countries?

The evidence is limited. However, the literature review revealed that 42 developing countries had at least some information on e-Health deployment. By far the largest country with such information was India. Libya had none. From the 42 countries where studies were available, the largest body of research was in the field of tele-medicine. This thesis is not concerned with tele-medicine and so these studies were not particularly useful. This left only ten full studies into e-Health (although numerous studies did allude to the results of additional ones).

There can be one of two explanations for this. Either e-Health is not being deployed in many developing countries. Or e-Health is being deployed but no articles and/or information about its deployment is being made available to academia. In either case, academically, the area is significantly under-researched.

RQ2. What distinct factors should be taken into consideration when HIT projects are implemented in developing countries compared to developed countries?

The research showed that there the unique factors that need to be addressed to contributing to a successful IT project in a developing country when compared to a developed one as shown in Figure 2-2. Indeed, the first version of the Network of Influence Model (with which this chapter culminates) can be applied to a proposed e-Health solution in any country developing countries. The main factors are: Financial, Governmental, Human, Technological Infrastructure, Organisational, Legislative and Academia. By far the biggest contributor to a successful HIT project is that the funding for its construction and maintenance is maintained.
RQ3. What factors influence the success/failure of the adoption of HIT in developing countries?

The literature review provided some interesting findings as to such factors. Some of the more obvious questions to be asked are: Is the project free from corruption? Will trained developers be available to create it? Will it be an ad hoc solution or based on an existing (stable) Open Source foundation? Will it be maintained? Is there enough money to deliver it?

If these questions cannot be answered in the affirmative then it is arguable the project should not be started. Further factors will contribute to its adoption however and a non-exhaustive list of these would include: Will enough developers stay with the project so that organisational memory is retained? Will the money keep coming even if the political situation changes? Is the ICT solution culturally appropriate (or will it need extensive rewriting)? Is it to be evaluated? If so, by who and how? Who will determine if it is really working as intended? If it is concerned in medicating patients, what level of pharmacovigilance is involved (so that it can stop certain pharmaceuticals being administered if the wealth of medical knowledge changes)?

Originally it was intended to use the answers to these questions to attempt a discussion of how the results could be specifically applied to Libya. However, the lack of any empirical studies into project failure in a country comparable to Libya means the discussion is less specific. Version 1 of the Network of Influence Model (NIM) does, however, embody all of the concepts that apply to Libya in modular form.
3 Research Methodology

3.1 Introduction
This chapter maps the strategies, methods and the tools that are used to ensure the research aim is achieved, namely to construct a Theoretical Framework for successful implementation of HIT systems in developing countries broadly, and specifically in Libya. Since HIT is considered a multi-disciplinary field, a systematic combination of research methods is required. Therefore, the mixed method approach is used as the research strategy for this study, and an explanation and discussion of this approach is given below. A complex multi-disciplinary phenomenon like health informatics requires a pragmatic approach to the subject matter. In addition, this chapter illustrates the various methods and techniques that underpin this research. (See Figure 3-1).

3.2 Methodological choices

Figure 3-1: The interconnection of worldviews, strategies of inquiry and research methods.

3.3 Overview of research methods

3.3.1 Philosophical Paradigms of Research

It is understood that each research method has its underlying philosophical assumptions which guide the research design, data collection, analysis and interpretation of the phenomenon under investigation from a particular perspective (Holden & Lynch, 2004; Remenyi, Pather, & Klopper, 2011). This research follows the scheme developed by Burrell and Morgan (2017) to examine the philosophical assumptions of the research methods in four dimensions: ontology, epistemology, human nature and methodology, with an aim to identify an applicable research approach for this study.

A research paradigm is a group of assumptions or ideas of how we view or think about some aspects of the world. The various existing philosophical paradigms have different views about the assumptions we often have about the nature of our world and our reality (ontology), and how knowledge can be acquired (epistemology) (Oates, 2005). There have been numerous arguments and debates in the literature addressing research philosophy. Nonetheless, understanding both sides of the argument is crucial, because some research topics entail flexible and compromise design to address more than one tradition (Easterby-Smith, Thorpe, & Jackson, 2012).

In social science, often there are two key research philosophical paradigms; namely, positivism and social constructionism. It has been argued by some research that a third research paradigm related to the field of Information Systems (IS) now exists, which Klein & Myers christened critical paradigm (Klein & Myers, 1999; Oates, 2005).

3.3.2 Positivism

Positivism is an approach often used to describe research which tries to understand societies using scientific methods. For example, using experiments and statistics in order to understand how societies operate.
The term was used for the first time by Auguste Comte in his books: The Course In Positive Philosophy and A General View of Positivism. His main focus was on developing theories that can be tested and have the potential to improve the world we live in. Furthermore, he was keen to create natural laws which can be applied to societies. He believed that natural science, for example biology and physics, is a critical stage in the development of social science.

Positivism is the oldest of the three paradigms (Oates, 2005). The positivism view is that the social world exists externally. For example, instead of inferred subjectively through reflection or instinct, positivism features should be measured through objective methods (Easterby-Smith et al., 2012). With regard to ontology, positivists consider that reality and the person who observes it are separated from each other. They believe that the researcher or the subject/phenomena being investigated are two separate and independent things (Ron, 2004).

### 3.3.3 Social Constructivist

Social Constructivist can be seen as an attempt in which to comprehend and translate how humans create and deal with their social world. It considers that reality is not objective and exterior; it is seen as socially constructed and people give it a meaning. (Ron, 2004) argues that ontology assumption is that reality, and the person who observes it cannot be separated from it.

There have been several studies comparing the implication of positivism and social constructionism. A study by (Easterby-Smith et al., 2012) illustrates the different perspectives of several authors, instead of examining it from a single viewpoint. Table 3-1 shows the comparison.
Table 3-1 Contrasting implications of Positivism and Social Constructivist

<table>
<thead>
<tr>
<th></th>
<th>Positivism</th>
<th>Social Constructivist</th>
</tr>
</thead>
<tbody>
<tr>
<td>The observer</td>
<td>Must be independent</td>
<td>Is a part of what is being observed</td>
</tr>
<tr>
<td>Human interests</td>
<td>Should be irrelevant</td>
<td>Are the main drivers of science</td>
</tr>
<tr>
<td>Explanations</td>
<td>Must demonstrate causality</td>
<td>Aims to increase general understanding of the situation</td>
</tr>
<tr>
<td>Research progress through</td>
<td>Hypotheses and deductions</td>
<td>Gathering rich data from which ideas are induced</td>
</tr>
<tr>
<td>Concepts</td>
<td>Need to be operationalised so that they can be measured</td>
<td>Should incorporate stakeholder perspectives</td>
</tr>
<tr>
<td>Units of analysis</td>
<td>Should be reduced to simplest terms</td>
<td>May include the complexity of whole situations</td>
</tr>
<tr>
<td>Generalisation through</td>
<td>Statistical probability</td>
<td>Theoretical abstraction</td>
</tr>
<tr>
<td>Sampling requires</td>
<td>Large numbers selected randomly</td>
<td>Small numbers of cases chosen for specific reasons</td>
</tr>
</tbody>
</table>

(Ron, 2004) has reported a comparison between the positivist and interpretive research approaches, as illustrated in Table 3-2.
Table 3-2 Differences between positivist and interpretivist approaches

<table>
<thead>
<tr>
<th>Metatheoretical assumptions about</th>
<th>Positivist</th>
<th>Interpretivist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ontology</strong></td>
<td>Person (researcher) and reality are separate.</td>
<td>Person (researcher) and reality are inseparable (lifeworld).</td>
</tr>
<tr>
<td><strong>Epistemology</strong></td>
<td>Objective reality exists beyond the human mind.</td>
<td>Knowledge of the world is intentionally constituted through a person’s lived experience.</td>
</tr>
<tr>
<td><strong>Research Object</strong></td>
<td>Research object has inherent qualities that exist independently of the researcher.</td>
<td>Research object is interpreted in the light of meaning structure of a person’s (researcher’s) lived experience.</td>
</tr>
<tr>
<td><strong>Method</strong></td>
<td>Statistics, content analysis.</td>
<td>Hermeneutics, phenomenology, etc.</td>
</tr>
<tr>
<td><strong>Theory of Truth</strong></td>
<td>Correspondence theory of truth: one-to-one mapping between research statements and reality</td>
<td>Truth as intentional fulfilment: interpretations of research object match lived experience of object.</td>
</tr>
<tr>
<td><strong>Validity</strong></td>
<td>Certainty: data truly measure reality.</td>
<td>Defensible knowledge claims.</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>Replicability: research results can be reproduced.</td>
<td>Interpretive awareness: researchers recognise and address implications of their subjectivity.</td>
</tr>
</tbody>
</table>
3.4 Research Approaches and Designs

A research approach is a method to garner knowledge, according to a plan or procedure, so that the data gathered can be collected, analysed and interpreted appropriately (Creswell, 2013). There are three common research approaches: quantitative, qualitative and mixed methods. We first consider the design, then the research strategy relevant to each approach.

3.4.1 Quantitative Designs

Quantitative designs use numbers to test hypotheses and make predictions by using measured amounts, ultimately describing an event using figures. By using numbers, we can have the chance to use advanced and powerful statistical tests to ensure that results can be presented as statistics.

When quantitative research is used, we need to describe what we are measuring. This will help us to look at a particular attribute or variable. This is often referred to as an operational definition. By operationalising what we are looking for, we are only measuring a particular and relevant thing, which restricts our view to what is relevant.

One of the advantages of using quantitative methods is that, by examining numbers, a certain level of bias can be removed. It is hard to argue that one kicking a ball, for instance, is not kicking a ball. For example, when a researcher studies a specific variable that is operationally defined, then the results can be applied to larger populations, enabling us to make generalisations from the findings.

3.4.2 Qualitative Designs

Qualitative Designs describe the kind and quality of a subject, while interpreting and attempting to understand a phenomenon. By using narrative descriptions, the purpose of qualitative research is to paint a mental picture of what the researcher is seeing.

Due to the nature of qualitative research, it is difficult to use statistical procedures to measure kinds and qualities, and research of this type typically focuses on a smaller
sample size when compared with quantitative research. Qualitative research depends partially on the researcher's personal view and description of a situation. This may lead to a certain level of bias and subjectivity in the description.

### 3.4.3 Mixed Methods Designs:

Mixed methods research refers to the use of a combination of quantitative and qualitative research methods, techniques, approaches, and concepts all brought together in one single study. This is used to produce multi-methods, techniques, and approaches that bridge the gap between different philosophies and their conflicts stance and reduce the potential weakness of investigated phenomena (Harwell, 2011; Johnson & Onwuegbuzie, 2004). As a methodology, “it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process” (Creswell, 2013).

It highlights the collection, analysis, and combination of the quantitative and qualitative results in a single study or series of studies. Its main idea is that combining quantitative and qualitative approaches would create a better understanding of the research problems than either approach alone (Creswell, 2013). Table 3-3 illustrates a comparison between the three methods.
Table 3-3 The difference between the three designs

<table>
<thead>
<tr>
<th></th>
<th>Quantitative</th>
<th>Mixed Methods</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-determined</td>
<td>Both predetermined and emerging designs</td>
<td>Emerging methods</td>
<td></td>
</tr>
<tr>
<td>Instrument based questions</td>
<td>Both open- and closed-ended questions</td>
<td>Open-ended questions</td>
<td></td>
</tr>
<tr>
<td>Performance data, attitude data, observational data, and census data</td>
<td>Multiple forms of data drawing on all possibilities</td>
<td>Interview data, observation data, document data, and audio-visual data</td>
<td></td>
</tr>
<tr>
<td>Statistical analysis</td>
<td>Statistical and text analysis</td>
<td>Text and image analysis</td>
<td></td>
</tr>
<tr>
<td>Statistical interpretation</td>
<td>Across databases interpretation</td>
<td>Themes, patterns interpretation</td>
<td></td>
</tr>
</tbody>
</table>

3.4.4 Qualitative strategies:
Creswell and Poth (2017) argued that there are five qualitative research strategies: biography, phenomenology, grounded theory, ethnography, and case study. Table 3-4 shows his comparison of the five strategies
Table 3-4 Comparison between the five approaches

<table>
<thead>
<tr>
<th>Focus</th>
<th>Biography</th>
<th>Phenomenology</th>
<th>Grounded Theory</th>
<th>Ethnography</th>
<th>Case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Exploration of an individual’s life</td>
<td>Understanding of a phenomenon’s experiences</td>
<td>Development of a theory grounded in data from the field</td>
<td>Description and interpretation of a cultural and social group</td>
<td>Development of a comprehensive analysis of a single case or multiple cases</td>
</tr>
<tr>
<td>Discipline origin</td>
<td>Anthropology, Literature, History, Sociology, Psychology</td>
<td>Philosophy, Sociology, Psychology</td>
<td>Sociology</td>
<td>Cultural, Anthropology, Sociology</td>
<td>Political Sciences, Sociology, urban studies, other Social Sciences</td>
</tr>
<tr>
<td>Data collection</td>
<td>Mainly interviews and documents</td>
<td>Long interviews with up to 10 people</td>
<td>Interviews with 20-30 individuals to ‘saturate’ categories and detail a theory</td>
<td>Mainly observations and interviews with additional artefacts during long time spent in the field</td>
<td>Various Sources: documents, archival records, interviews, observations, physical artefacts</td>
</tr>
<tr>
<td>Data analysis</td>
<td>Stories, Epiphanies, Historical content</td>
<td>Statements, Meanings, Meaning themes</td>
<td>Open Coding, Axial Coding, Selective Coding, Conditional Matrix</td>
<td>Description, Analysis, Interpretation</td>
<td>Description, Themes, Assertions</td>
</tr>
<tr>
<td>Narrative form</td>
<td>Thorough illustration of an individual’s life</td>
<td>Description of the ‘essence’ of the experience</td>
<td>Theory or theoretical model</td>
<td>Description of the cultural group behaviour</td>
<td>In-depth study of a single ‘case’ or multiple ‘cases’</td>
</tr>
</tbody>
</table>

3.5 Quantitative Strategies

There are four types of research design for this type: Descriptive, Correlational, Causal-Comparative/Quasi-Experimental, and Experimental Research. Table 3-5 below illustrates the different types in more details.
### Table 3-5 Type of quantitative design

<table>
<thead>
<tr>
<th>Type of quantitative design</th>
<th>Descriptive research</th>
<th>Correlational research</th>
<th>Causal-comparative/quasi-experimental research</th>
<th>Experimental research</th>
</tr>
</thead>
</table>
| **Studies from this type aims to explain the present status of a particular variable**<sup>2</sup>. In addition, these research studies are often designed to obtain a systematic information about a specific phenomenon. The studies which falls in this category does not usually start with developing hypothesis, instead they are likely to be developed after the data are collected and analysed.  
**Example:**  
A description of how second-grade students spend their time during summer vacation. | This type design tries to establish the relationship between two or more than one variable in which statistical data are used. Furthermore, it determines and interprets the relationships between several facts by recognising trends and patterns in the data. However, this type of research does not go as far as to establish the cases and effects of the observed patterns.  
**Example:**  
The relationship between intelligence and self-esteem. | Research from this type is typically establish the causes and effects among the involved variable in the study. Its design can be very similar to experimental design. Though, there are some important differences.  
**Example:**  
The effect of part-time employment on the achievement of high school students. | Some researchers referred to this type of research as a true research, because it uses scientific methods to establish the causes and effects using a group of variables. The true experiments has often seen as a laboratory study, however, this is not always the case. For example, a true experiment is any research where the main focus will be to identify and have control on all variable excluding one variable. Manipulating an independent variable to see the effect on the other variables.  
**Example:**  
The effect of a new treatment plan on breast cancer. |

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<sup>2</sup> A variable is something that can change (For example, age or gender). A variable is normally the centre of research.
3.6 Research Objectives and Questions

As noted in the Literature Review, one of this thesis’s research objectives is to assess the strengths and weakness of HIT in developing countries, and explore the Critical Success Factors (CSFs) that can lead to successful implementation of HIT in developing countries.

The focus of this research will be on the following aspects, therefore, a mixed methods approach is used to guide and help achieving them:

a) Multi-stakeholder perspective on HIT
b) Stakeholder analysis
c) How success and failure is interpreted by each stakeholder
d) The usage of HIT in healthcare institutions in developing countries broadly and specifically in relation to Libya

Research questions convert exploratory thoughts and ideas about a certain phenomenon to a specific objective, and the questions themselves must connect to its overall aim and objectives. This research seeks to answer the following primary research question, modified by the systematic literature review:

Q1. What factors influence the success/failure of the adoption of HIT in developing countries?

In addition, this research addresses several subsidiary research questions, which provide the foundation for exploring the critical factors that could contribute to successfully implementing HIT in developing countries:

Q2. To what extent has HIT been deployed in developing countries?

Q3. What distinct factors should be taken into consideration when HIT projects are implemented in developing countries compared to developed countries?

Q4. To what extent have HIT systems been adopted by healthcare providers in Libya?

Q5. What implementation metrics are being used in HIT projects in developing countries to measure success?
Furthermore, this chapter illustrates how the secondary research questions formed the research process, which leads to the definition of “success” and “failure” in the context of HIT.

3.7 Research methods selection and justification

3.7.1 Social Constructivist Paradigm
In this thesis, the Social Constructivist Paradigm has been adopted, with the assumption that it is an appropriate approach in order to understand HIT phenomenon through the ways that people make sense of it (Easterby-Smith et al., 2012). This study is interpretative in nature since it seeks to understand the drivers and barriers for the implementation of HIT systems in developing countries by interpreting the socio-technical factors.

This study conveys the reality of the social world in which we live; that, of course, is the nature of all good research involving social phenomena (Lowery & Evans, 2004). Therefore, it is assumed throughout that our knowledge of reality has been gained through social constructions such as language, consciousness, shared meaning, documents, tools and other artefacts (Klein & Myers, 1999). Using the Constructivist paradigm allows us to increase understanding of the social and organisational issues related to development and implementation of HIT systems in healthcare organisations.

3.7.2 General Justification for using Mixed Methods as the Research Strategy
When conducting research within healthcare, the researcher faces numerous challenges. For instance, the involvement of different parties in the process of healthcare delivery, complexity of healthcare management and the fact it is a multi-disciplinary field.

To understand these challenges requires a very thorough investigation of the way such systems are utilised in practice. Interviewing the stakeholders who are involved in the
A Mixed Methods research strategy will be followed in this research. Mixed Methods has been defined in different ways by academics. In a study by (Johnson, Onwuegbuzie, & Turner, 2007) in which 19 research strategy definitions were illustrated, it was (Creswell & Clark, 2007) who provided the most comprehensive definition of the Mixed Method approach:

“Mixed Methods research is a research design (or methodology) in which the researcher collects, analyses, and mixes (integrates or connects) both quantitative and qualitative data in a single study or a multi-phase program of inquiry”.

Any problem under investigation requires a unique and proper method designed and implemented effectively (Strauss, 1987; Trochim, 2006). This section justifies why a Mixed Methods approach will be employed (Creswell, Plano Clark, Gutmann, & Hanson, 2003). (Creswell & Clark, 2007; Ivankova, Creswell, & Stick, 2006) argue that this approach allows for a better understanding of the research problem rather than using either the qualitative or quantitative approach only. The Mixed Methods approach supports both inductive and deductive logic used in the same research. Mixed Methods research has been chosen for this research because it is believed to bridge the gap between the conflicting methodological paradigms (Johnson & Onwuegbuzie, 2004; Sharp et al., 2012).

As mentioned above, this research aims to answer five research questions in relation to the Critical Success Factors (CSFs) for implementing HIT in developing countries.

The mixed methods approach has been accepted and used widely in the context of social science research (Bryman & Bell, 2011). This methodology ensures a fuller understanding of the implementation of HIT projects in the broad context of developing countries because HIT is a multi-disciplinary field. Combining both methods allows a process of healthcare delivery can help to get the full picture of the phenomena using a pragmatist approach. For example, in order to understand and predict the weather, scientists need to see the Earth from a satellite. The same analogy applies to HIT; a variety of different techniques need to be used for the actual study, but it is essential to observe the interoperability of the different stakeholders from an aerial position.
holistic understanding (Kaplan & Shaw, 2004). Further, because the main aim of this research is to develop theory, rather than testing a hypothesis or existing theory, the methodology needs to be flexible. Therefore a mixed methods approach is more appropriate than a single method approach (Scott & Briggs, 2009). Mingers (2001); Plattfaut (2014) argue that the Mixed Methods approach is considered to be relevant and valuable for Information Systems research due to the following intrinsic characteristics:

1. The world we live in is complex and multi-dimensional, therefore using a single method to capture data seems to be insufficient. Thus, "multi-method research is necessary to deal effectively with the full richness of the real world” (Mingers, 2001, p. 243)

2. The findings of research which use the Mixed Methods approach are considered to be reliable and robust. This is because the Mixed Methods approach may compensate the limitation of any one method with the enhancing of another, and can provide robust analysis (Ivankova et al., 2006; Teddlie & Tashakkori, 2009). “The rationale for mixing both kinds of data within one study is grounded in the fact that neither quantitative nor qualitative methods are sufficient, by themselves, to capture the trends and details of a situation” (Ivankova et al., 2006, p. 3).

It is intended to capture the current trends and details of the situation by analysing the results obtained from the qualitative phase to inform the second phase of the research, help design the questions and explain the meaning of the quantitative data. Since the objective of this research is to develop a multi-stakeholder model, data will be collected using various instruments from different stakeholders. The data will be provided by public and private institutions; namely, hospitals, IT providers, final year medical students and policymakers at the Ministry of Health and the Ministry of Communications, as well as members of the general public in Libya.

As a result of the methods used, the research questions are answered pragmatically (Creswell, 2012; Zethsen & Slatyer). This is certainly not unique to this thesis or this
methodology of study. Indeed, the Mixed Methods approach is very often used in HIT as the research method precisely because of its multi-disciplinary nature.

After finalising the methods to be used for the research, a Focus Group will be used to validate the theoretical model derived from it. This group will be composed of a panel of experts purposefully selected from both Upper Income Countries and Low and Middle Income Countries.

### 3.8 Qualitative methods

#### 3.8.1 Grounded Theory

Numerous definitions of Grounded Theory exist. Glaser and Strauss (1967) describe Grounded Theory (GT) as a “strategy for handing data in research, providing modes of conceptualization for describing and explaining”. Martin and Turner (1986) define grounded theory as a “an inductive theory-discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data”.

GT, first developed by Glaser and Strauss in 1967, presents a research methodology for developing a theory that is grounded in data systematically gathered and analysed (Corbin & Strauss, 2008). Charmaz (2006) discusses various criteria for evaluating GT: credibility, usefulness, originality and resonance. These criteria can be seen as guidelines to ensure the quality of the research.

GT is considered to be suitable for this research for the following reasons:

1. GT allows theory building rather than theory testing
2. GT allows “the discovery of theory from data” Glaser and Strauss (1967, p. 1)
3. GT will allow the creation of theory that is grounded in the “voices, actions and experiences of those studied” (Goulding, 2002).
4. Since there is a knowledge gap in relation to the HIT in Libya, and there is no theoretical foundational to test and draw hypotheses to test from, GT will be effective in generating a new theory to fulfil the research aim of developing a theoretical model.

GT was therefore chosen to guide the collection and analysis of the data and to construct the theoretical model from the data. To this end, two studies were conducted. The first was into the use of m-Health services and how they would impact the delivery of healthcare services in Libya. The second was concerned with exploring the Critical Success Factors which influence the implementation of a HIT solution in any developing country.

3.8.2 Case Study Research

Case Study Research is one of the most common qualitative research methods used in the field of IS (Myers, 2008; Plattfaut, 2014). Several definitions are used in the literature of Case Study Research.

According to Yin (2013), “A case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.” Case Study Research is especially suitable when “how” or “why” questions are being asked (Yin, 2013), which is the case for the research questions as in 3.6. In general, case study researchers examine a phenomenon in its natural setting with as little interference as possible (Oates, 2005).

There are several questions the researcher needs to address in order to determine whether the case method is a suitable approach for the investigated phenomenon (Benbasat, Goldstein, & Mead, 1987) and these are:

1. Can the phenomenon of interest be studied outside its natural setting?
2. Must the study focus on contemporary events?
3. Is control or manipulation of subjects or events necessary?
4. Does the phenomenon of interest enjoy an established theoretical base?
The Case Study Research has been described by Yin (2003) as “conducting an empirical investigation of a contemporary phenomenon within its natural contexts, using multiple sources of evidence”. The rationale of selecting the Case Study Method as an appropriate research strategy is because of its various intrinsic features (for a comprehensive list of these, see Hancock and Algozzine (2006), one of the most important in relation to this research is that it involves systematic steps designed to convey careful analysis of the case.

The Case Study Method copes with the technically distinctive situation in which there will be more variables of interest than data points, as one result depends on multiple sources of evidence. Data is then triangulated to produce a result that benefits from the development of the theoretical propositions and guides further data collection and analysis.

Case studies often combine data collection methods including archives, interviews, questionnaires and observations. The evidence may be qualitative (e.g., words) or quantitative (e.g., numbers) or both (Eisenhardt, 1989) Case studies can be considered as a multipurpose approach, because they can enable us to accomplish various aims for example providing a description to a phenomenon, test a theory, or generate a theory.

Benbasat et al. (1987) concluded that there are nine characteristics of case studies. These are as follows:

1. The phenomenon is examined in a natural setting
2. The data is collected by multiple means.
3. One or more entities (people, groups or organisations) are examined.
4. The complexity of the unit is studied intensively.
5. The investigator should have a receptive attitude towards exploration. (Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process.)
6. The investigator may not specify the set of independent and dependent variables in advance.

7. Changes in site selection and data collection methods may take place as the investigator develops new hypotheses.

8. Case research is useful in the study of "why" and "how" questions because these deal with operational links to be traced over time rather than with frequency or incidence.

9. The focus is on contemporary events.

Case studies can be single or multiple case designs. The single-case design is justifiable when the case represents a critical test of existing theory; the case is a rare or unique event, or when the case serves a revelatory purpose (R. K. Yin, 2002). A single case used for exploration may be followed by a multiple-case study (Benbasat et al., 1987).

Multiple-case designs are desirable when the intent of the research is description, theory building or theory testing. Multiple-case designs allow for cross-case analysis and the extension of the theory, as they can be used to compare the similarities and differences between cases. Multiple-case studies follow replication logic, meaning that cases are selected for theoretical, not statistical, reasons. The goal of theoretical and literal sampling is to choose cases which are likely to replicate, extend or violate the emergent theory.

Interviews are considered to be the most effective and common of all qualitative methods among the range of the other tools. They enable us to generate insights into how respondents see the world (Bryman, 2015; Easterby-Smith et al., 2012). Moreover, interviews are viewed as one of the most key sources of case study data collection.

Qualitative interviews might take various forms. Predominantly, case study interviews are of an open-ended nature (unstructured interviews), in which the researcher can ask key respondents for the facts of a matter as well as for the respondents’ opinions about events. A second type of interview is a focused interview (semi-structured interview), in
which a respondent is interviewed for a short period of time and the researcher is more likely to be following a certain set of questions derived from the case study protocol. They are conducted on the basis of loose structure consisting of open ended questions that define the area to be explored, at least initially, and from which the interviewer and the interviewee may diverge in order to pursue an idea in more detail. A third type of interview called the structured interview entails more structured questions, along the lines of a formal survey. Such a survey could be designed as part of a case study.

A case study also enables the facilitation of the exploration of a particular phenomenon, entity, event or individual from diverse data sources (Baxter & Jack, 2008; Yin, 2013). This is another relevant reason which will enable the researcher to collect data from various sources which will be described in detail in the research design section. It ensures that the exploration takes a profound understanding from multiple perspectives (Baxter & Jack, 2008). This also enables this study to investigate all the stakeholders involved in process of the HIT systems delivery with their different perspectives on the HIT systems infrastructure.

The case study has also been lauded for giving researchers a holistic view of certain phenomena, as well as for providing a round picture of the evidence available. It is useful in capturing the emergent properties of life in organisations, including the flow and changes within them (Noor, 2008). This is another reason why the case study is used in this research. Data was gathered and analysed applying the principles of GT throughout all the cyclic processes, including literature review, reflecting and data analysis.

3.9 Research Ethics Aspects

The University of Portsmouth Policies and Regulations compel all researchers to adhere and comply with all UK and International regulations by applying ethical approval from the competent authorities, prior to conducting any studies. These laws are to ensure that the research will not harm its participants (Babbie & Rubin, 2008; Neuman, 2005) and their privacy will be protected.
After reviewing details explanations of the process of conducting the interviews and handling the data were provided, a certificate of Fast Track Ethics Review was obtained and approved by the School of Computing Research Ethics Committee Representative at the University of Portsmouth (see appendix A). Once the approval was given, the study was initiated.

Prior to signing the consent form and conducting the interviews, an explanation was given to all participants in the form of an information sheet. An informed consent were distributed among the participants and signed by each of them.

3.10 Overall Research Methodology

The overall research methodology describes the techniques and procedures that will be followed to answer the research questions, which involves the process from identifying the research problem, validity, objectively and economically. Figure 3-2: illustrates the overall research methodology.
Figure 3-2: illustrates the overall research methodology

**Phase 1**
- Research questions
- Literature review
- Problem identification
- Version 1 of the model

**Phase 2**
- Case studies
  - Pilot study 1
    - Main Study 1: mHealth in Libya
      - Qualitative data collected from different stakeholders using in-depth interviews using (Skype phone calls) with policy makers, practitioners, vendors and IT providers.
      - Quantitative data collected using online survey.
  - Pilot study 2
    - Main Study 2: Exploring the CSFs of HIT in developing countries
      - Qualitative data from different stakeholders.
      - In-depth interviews using (Skype phone calls) with stakeholders.

**Phase 3**
- Version 2 of the model
- Data analysis
- Further data analysis
- Conducting further literature review

**Phase 4**
- Model validation: Stage 2
- Changes to the model
- A prototype version of the model, a theory related to HIT in developing countries developed.
- Modified Delphi study with participants from developing and developed countries purposefully selected.
It consists of four major phases. During Phase 1, the research questions were formulated, the literature review was conducted, the problem the thesis would address was refined, and the first version of the NIM was developed.

Phase 2 builds upon the initial qualitative results obtained, and uses the combination of Phase 1 and Phase 2 as a foundation for conducting study 3 which will inform the data collection. Hence, the design of the research instruments depends entirely on the previous studies. The data from the three studies is separate, but still interconnected.

### 3.11 Nature of Data Collected Through the Research Programme

<table>
<thead>
<tr>
<th>Method(s)</th>
<th>Targeted stakeholders</th>
<th>Objective(s)</th>
<th>Study design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative</td>
<td>Academics, admin staff in healthcare providers, physicians, IT developers, policymakers, final year medical students</td>
<td>To investigate the current state of the HIT in Libya, and help to design the qualitative data collection instrument.</td>
<td>Online survey</td>
</tr>
<tr>
<td>Quantitative</td>
<td>Academics, admin staff in healthcare providers, physicians, IT developers, policymakers, final year medical students in Libya</td>
<td>To investigate the current state of the HIT in Libya, and help to design the qualitative data collection instrument.</td>
<td>Semi-structured interviews</td>
</tr>
<tr>
<td>Quantitative</td>
<td>People from the general public, medical staff, IT developers,</td>
<td>Exploring the critical success factors influencing the implementation of HIT.</td>
<td>Online and offline survey</td>
</tr>
</tbody>
</table>
policymakers, final year medical students, academics from various developing countries

In addition it to help constructing the theoretical model.

Qualitative
All the participants were in senior positions, academics who were specifically targeted.

To improve and validate the developed model

Modified Delphi study approach.

### 3.12 Conclusion

The literature review was used to develop a theoretical model called the Network of Influence Model (NIM). In this chapter, the philosophy employed in constructing the NIM has been outlined. The purpose behind this is to introduce the methodology used in its construction. Several paradigms have been considered and it is the Constructivist Paradigm to which the NIM is most closely allied.

The scope of the work required to validate the NIM was also outlined. It will be validated by two surveys, and each of these will implement the mixed methods approach in order to prove the theoretical model through the use of qualitative and quantitative data. The results are expected to validate the NIM and hence to prove its academic merit. How these results will be further used to measure the NIM's objectivity and validity was then further set out through the use of established tables and phases.

Some of the difficulties of creating a theoretical model in a field so complex as healthcare were also discussed.
4 The case study of the Libyan wounded personal in Greece

4.1 Introduction

This chapter is a study that sought to reflect on the case of Libyans who sustained various forms of injuries during the 2011 uprising and were sent by the Libyan State to Greece for medical treatment.

The main sources of information for this case study were: personal experience with the Libyan context, an informal interview with the member of staff from the Libyan embassy who requested to be kept anonymous and a report written by a Libyan journalist and published on Facebook. We were unable to find any material in either grey or peer-reviewed literature for this study.

It has been reported that the Libyan State sent a large number of people who were injured during the 2011 uprising abroad for treatment of which the vast majority of them, in excess of 3000 were sent to Greece. The Libyan embassy in Greece and the Libyan medical office in Greece were managing and coordinating between the hospitals in Greece and the Ministry of Health (MoH) in Libya.

This study aimed to draw lessons from events that occurred during this period. A large number of patients were sent from a developing country to a developed country for medical treatment. We thought reflecting on how personal and health information were being exchanged would be very relevant to the growing research in the area of health information exchange especially in developing countries and the use of information technology to help improve the quality of health care delivery.

This study aimed to address the following three research questions:

RQ1- Has the MoH in Libya provided any medical data about the patients to the hospitals in Greece?

RQ2- What is going to happen to the data the Greek hospitals are collecting from the patients?

RQ3- Will the collected data be handed back to the MoH?
4.2 Methods:

The first point of contact was carried out using personal contacts in Greece. The aim was to collect rich qualitative data using semi-structured interviews from members of staff at the Libyan embassy in Greece, and the medical office which was particularly established for this purpose. Semi-structured interviews guide were developed for this study. The plan was that the interviews would be transcribed and analysed using thematic analysis.

4.2.1 Study Participants

Although it is difficult if not impossible to predict the exact required number of participants to reach data saturation in qualitative data research. The aim was to recruit 20-30 participants. This number would be mixed between admin staff and Libyan medical doctors are mediated between the embassy and the Greek hospitals.

4.3 Results

The visit took place between 18/08/2014 and the 05/09/2014. Unfortunately, the agreement which was made with the staff at the Libyan embassy in Greece was not honoured. Therefore, no interviews were conducted.

4.4 Discussions:

The first point of this research started by arranging for the visit to conduct the research through a personal contact who knew some people working at the Libyan embassy in Greece. A number of informal contacts were made with staff who were working at the medical office. The aims was to discuss the objectives of the study in detail with them. They embraced the idea and arrangements were made for HN to travel to Greece to conduct the required interviews.

On the 18/08/2014 the researcher travelled to Greece to start the data collection the second day. On the 19/08/2014 we started off with the person who was our first point of contact. We cannot state his role at the embassy because he has requested to be anonymous. He informed us that the people in charge of the embassy would require an official letter from the research supervisor and then he will do his best to allow us to
start the second day. The letter was provided to him that same day and we also informed him that we had very limited time. It took about three days for them to respond. They requested more information about the research, which we provided. Their final decision was, due to unforeseen circumstances it is not possible to interview staff from the embassy, however, they suggested to interview four Libyan patients at a Greek hospital. Furthermore, our contact person from the embassy suggested we interviewed this person outside the embassy e.g. in a café. We informed him that it is not going to be possible to interview him for various reasons: (a) one interview is not going to be enough for the study, (b) Although the interviewer agreed to meet with us in a café, we did not deem it practical to have the recording in a public place. However, we met informally for a chat where we were told why the interview was cancelled. The interviewee mentioned that the people in the embassy were alarmed and thought the study is an ongoing undercover investigation, especially since it is believed that millions of euros have been spent that cannot be properly accounted for. It was also rumoured that the authorities in Libya may be aware of this and some may have benefitted personally.

Despondently and with great regret the research was called off and the researcher went back to the UK without the data we were planning to get.

4.5 Conclusion

The study was aiming to investigate what is going to happen to the data the Greek hospitals were collecting about a large number of patients (according to the informal interview the number of patients exceeded 3,000). We believe these data could have been used back in Libya by the healthcare providers. Nonetheless, the issues which we highlighted earlier had prevented us from achieving that. It has been reported in a Facebook page there was a huge corruption case at the Libyan in Embassy as a result of the Libyan government sending wounded people after 2011 uprising for medical treatments in Greece.

Overall, there are some lessons which can be learned from this study: (a) there is a lack of awareness among the policymakers in Libya about the potential benefits of conducting academic research to inform practice; (b) Corruption is widely practised at
the Libyan institutions not only inside Libya but in its embassies abroad which one would expect that these places are run by highly educated people who represent their country; (c) the difficulties of academic research in developing countries context, particularly the political instability and the social norm of corruption. There is also a clear indication that there may exist some form of arrangements between those who are in charge in the ministries in Libya and the embassies to embezzle resources and cover up for them.
5 HIT in Libya with special focus on mHealth (Study 1)

5.1 Introduction
The first phase of my research was to conduct a survey of users of healthcare services in Libya. This was done in order to gain an understanding of whether a change to existing healthcare systems would be welcomed by the users of those services. This research is unique to this thesis.

The objectives of conducting it were as follows:

1. To answer the primary research questions (See further Chapter 1),

2. To examine the perception of stakeholders, involved in the delivery of healthcare services in relation to an implementation of HIT systems in Libya, and

3. To discuss the ideas, concerns and expectations of stakeholders involved in delivering healthcare in Libya in relation to the existing Health Information Systems and its planning support.

5.2 Methods

5.2.1 Literature Review
Despite the comprehensive literature review carried out, nothing was uncovered that addressed the adoption of HIT in Libya. (Indeed, only a few studies were found which address the adoption of the IT in the other sectors of the economy, and it was not sufficient to be of any benefit to this study.)

As there was no evidence of a systematic collection of information and knowledge regarding the challenges facing the people in Libya when they use their mobile devices to access healthcare information, this study was conducted intending to fill this gap. The following study depends mainly on my own survey and my own experiences (since the author of this thesis is from Libya and has lived there for a long time).
5.2.2 Questionnaire Survey

Survey methods have been widely implemented in the field of HIT research; this involves three key forms namely: ad-hoc surveys, cross sectional surveys and longitudinal surveys (Kaduruwane, 2012; Pearson, 2007).

Ad-hoc surveys are often used to investigate a phenomenon when the requirement is to obtain particular knowledge over the course of a short period of time. The cross-sectional survey consists of a broader context and a timeframe involving more participants, with the purpose of obtaining a broad overview of a phenomenon.

The longitudinal survey methods are employed to study a phenomenon in relation to a selected population over a period of time. The design and development of this questionnaire was based on the analysis of the data collected from the phase 1 of the research, reviewing the published literature on HIT in developing countries (Hanmer, 1999; Odhiambo-Otieno, 2005; Özkan, Baykal, & Sincan, 2006; Yusof, Papazafeiropoulou, Paul, & Stergioulas, 2008).

Survey methods are often associated with the use of a questionnaire. A questionnaire could be administered by various methods such as face-to-face, by telephone or self-completed through the post or online. It is to be noted that although survey methods tend to address questions that are both descriptive and analytical, they have limitations in relation to exposing causative influences.

In addition, the questionnaire survey is probably the most widely used and well-tested method for obtaining data from a selected population. If correct sampling techniques are used with careful planning, the findings can be generalised to large populations. As it has been argued, the questionnaire surveys are particularly effective when used to compare changes over time.

Several weaknesses are also reported in the literature in relation to questionnaire surveys based on online and postal methods. Some of these are, difficulties in avoiding response bias, difficulties in using open-ended questions, inability to control question sequence and difficulties in motivating respondents to answer boring questions (Saks & Allsop, 2007).
The survey was available for five weeks between 15th March 2016 and 19th April 2016. The survey for this study was developed by reviewing the current literature on m-Health and Health Information Systems in developing countries.

5.2.3 Sample and Data Collection

Two identical versions of the questionnaire survey were produced in two languages, Arabic and English (see Appendix B). The questionnaire consisted of 27 questions. Closed- and open-ended questions were used; the later used to obtain the participants’ opinions regarding the use of mobile devices in the delivery of healthcare services. The survey was designed using Survey Monkey (2016).

The target respondents comprised different stakeholders who are involved in the delivery of healthcare services on behalf of the Libyan State (i.e. state-funded hospitals), and private institutions (i.e. private hospitals). In this research, semi-structured interviews, questionnaire surveys were administered with different stakeholders including medical staff, policymakers and IT providers. Since this research uses Grounded Theory to collect and analyse data, the number of participants cannot be pre-identified until data saturation is reached; it is estimated it takes roughly 20 to 30 interviews; participants were invited to participate through the phone and Skype. With respect to the survey distributed online and offline, the offline version was printed and distributed to get the maximum number of participants.

5.2.4 The Pilot Study

The survey was piloted to test its effectiveness, and to assess the validity and reliability of the questions in the survey. Furthermore, the aim was to determine whether its structure, and the questions within it, required any modification before the actual study was conducted. The survey was piloted with fifteen PhD students from the Faculty of Technology at the University of Portsmouth. The participants were emailed the URL of the survey, and we had twelve responses from the participants. Based on the feedback we had from the pilot study, some of the questions were rephrased.
5.2.5 The Respondent Recruitment Process

Respondents were invited to participate in the questionnaire using social media programmes including: WhatsApp, Facebook, Viber, text messages, emails, and snowballing technique using the URL of the questionnaire designed using Survey Monkey. The starting point was emailing the survey’s URL to a Facebook group whose members are final year medical students from Zawia University in Libya. The students started forwarding the URL to their colleagues and friends. The aim was to reach as many respondents as possible. The sample size is considered to be critical for research (Mason, 2010), because the sample size provides the means to obtain knowledge from various perspectives which could provide important data for analysis, interpretation, and drawing of conclusions. However, because the goal of the survey was mainly qualitative, it was not appropriate to do a statistical sample calculation, instead the aim was to keep sampling until data saturation is achieved.

5.2.6 Data Collection Technique and Protocols

This study used both qualitative and quantitative research approaches during the data collection and analysis. Data was collected from various stakeholders involved in the delivery of healthcare services in Libya from the public and private sector. Two separate studies were conducted during this stage of the programme.

Firstly, the questionnaire was distributed to all the stakeholders to capture quantitative data. Secondly, semi-structured interviews were conducted to capture qualitative data. Quantitative data was analysed using descriptive statistics. The qualitative data was provided by the opinions of the participants.

There were 10 questions in the semi-structured interview and 27 questions in the survey. (See Appendix B). The data collection protocols contained in the semi-structured interviews contain specific steps to ensure a positive working relationship is forged with selected participants by informing the participants about the study, acquiring their consent, asking questions multiple times to ensure clarity and ensuring participants understand they can withdraw from the study at any point (see Appendix B).

Participants were assured any data collected in this study would be kept strictly confidential and would only be available to those involved in the research. Nevertheless
it is worth reporting that some of the participants were reluctant to take part in the study once they were informed that the interview would be tape recorded.

Those participants who did not wish to be recorded had their wishes respected and the interview went ahead with the researcher instead taking notes manually. Assuming that most participants did not want to be tape-recorded for fear they could be identified by their voices, the effect on this study would seem to be minimal. This is because one would assume participants would be as open, if not more so, once reassured that they would not be recorded.

5.3 Results

5.3.1 Demographics

The survey questions were designed to capture the characteristics of the participants who took part in the study. All respondents live or have lived in Libya. They came from various backgrounds.

Of the 236 received responses, only 182 responses were included in the study because 54 responses were either duplicated or incomplete. It was not possible to include the responses which were not complete as there are only two or three questions answered.

The gender distribution of respondents was (60% male, 40% female).
Table 5-1 shows the age distribution of the respondents.

<table>
<thead>
<tr>
<th>Age Spread</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>36.2%</td>
</tr>
<tr>
<td>25-34</td>
<td>35.1%</td>
</tr>
<tr>
<td>35-44</td>
<td>10.9%</td>
</tr>
<tr>
<td>45-54</td>
<td>10.9%</td>
</tr>
<tr>
<td>55-64</td>
<td>5.49%</td>
</tr>
<tr>
<td>65 and Over</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

A large number of the respondents in this survey (43%) are studying or have a Bachelor’s degree (or equivalent), 21% are still studying or have High School certificate or equivalent, and 26% are still studying or have Postgraduate degree. Only 1% of the respondents had no formal qualification or degree. The explanation of these findings could be attributed to the fact that education in Libya is free (See Table 5-2). The implication of this is discussed in 4.4.

Table 5-2 Level of education of survey respondents.

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>1%</td>
</tr>
<tr>
<td>High School or equivalent</td>
<td>21%</td>
</tr>
<tr>
<td>Bachelor degree or equivalent</td>
<td>43%</td>
</tr>
<tr>
<td>MSc degree or equivalent</td>
<td>12%</td>
</tr>
<tr>
<td>PhD/MD</td>
<td>13%</td>
</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
</tbody>
</table>
5.3.2 Mobile Phones Access and Use

Of the 182 respondents, 175 indicated that they own a smartphone, five participants had a more basic phone, and only two participants affirmed that they do not have a mobile phone, as shown in Table 5-3.

Table 5-3 Ownership of mobile device usage by type.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own mobile phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>180</td>
<td>1%</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>99%</td>
</tr>
<tr>
<td>Type of mobile phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic phone</td>
<td>5</td>
<td>3%</td>
</tr>
<tr>
<td>Smart phone</td>
<td>175</td>
<td>97%</td>
</tr>
<tr>
<td>Access to Internet on mobile devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>170</td>
<td>93%</td>
</tr>
<tr>
<td>No</td>
<td>12</td>
<td>7%</td>
</tr>
</tbody>
</table>

Respondents were asked if they could access the Internet on their mobile devices. The vast majority (93%) could, on payment of a subscription fee, access to the Internet through their mobile device. Table 5-3 illustrates this.

However, there is an important proviso, respondents were also asked how much their telecoms provider charged for a monthly Internet subscription. The average cost ranged from 30-40 Libyan Dinar (equivalent to £6-£8 when the study was conducted). More than half the participants considered the cost of the monthly subscription to the Internet unaffordable and therefore did not pay for it.

5.3.3 The Awareness of the Use of Mobile Devices in Healthcare Delivery

Participants were asked if they knew or had heard about the possibility to use m-Health to enhance the healthcare delivery. Just above half of the participants were aware of m-Health. See Table 5-4.
Table 5-4 Awareness of the use of mobile devices in healthcare delivery.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>knew or heard about the potentials of m-Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>85</td>
<td>47%</td>
</tr>
<tr>
<td>No</td>
<td>97</td>
<td>53%</td>
</tr>
</tbody>
</table>

The results of this survey indicate not only that Libyan healthcare professionals remain significantly behind those operating in other developing countries (for example, Kenya (Agoro et al., 2017)) but may also confirm a lack of social desirability bias towards m-Health at the current moment.

5.3.4 Factors which could encourage people in Libya to use mobile devices to access health information

The majority of the participants considered the ease of use of a mobile device, the fact it is easily accessible and that using it may potentially save them a lot of time as the most common factors that would encourage them to access their medical records using them. This was in line with my expectations.

5.3.5 Qualitative Data

This was achieved through semi-structured interviews which were conducted with healthcare professionals, IT providers, Final year university medical students plus members of the general public (eventual end users). 25 participants took part in the study as shown in Table 5-5.

Figure 5-1 illustrates some of the themes that emerged from the responses regarding two questions of the interviews. In the first one, participants were asked what would encourage them to use their mobile devices to access their medical records. In the second, participants were asked about what might discourage them from using their mobile devices to access their medical records.
Table 5-5 Demographics of the interview participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18</td>
<td>72%</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthcare professionals</td>
<td>8</td>
<td>32%</td>
</tr>
<tr>
<td>IT providers</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>Final year Medical students</td>
<td>6</td>
<td>24%</td>
</tr>
<tr>
<td>General public</td>
<td>7</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Age Spread</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>25-34</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>35-44</td>
<td>7</td>
<td>25%</td>
</tr>
<tr>
<td>45-54</td>
<td>6</td>
<td>24%</td>
</tr>
<tr>
<td>55-64</td>
<td>5</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor degree or equivalent</td>
<td>12</td>
<td>48%</td>
</tr>
<tr>
<td>MSc or equivalent</td>
<td>6</td>
<td>24%</td>
</tr>
<tr>
<td>PhD/MD</td>
<td>7</td>
<td>28%</td>
</tr>
</tbody>
</table>
Figure 5-1 Factors which may encourage/discourage people to use mobile devices.
In the above diagram are recurring themes determined by qualitative analysis, we have not established the frequency of the number of participants, because the diagram is based on the qualitative data from both the survey and the semi-structured interviews.

5.3.6 Keeping Data Electronically

As shown in Figure 5-2 below, participants were asked to express their view about their data being kept electronically by healthcare providers. The responses to this question were divided into three categories. On one hand, some of the participants agreed that their data could be kept electronically, as it may save their lives or improve the healthcare services by allowing doctors to check their medical history. On the other hand, some participants rejected the idea, stating the absence of legislation that protects data in Libya.

![Figure 5-2 Respondents’ views on keeping data electronically.](image)

5.3.7 Factors Which May Help/Hinder The Implementation of m-Health

As with most of the world, mobile phones have replaced land-line phones as the primary method of communication in Libya. Even though there is a wide disparity of wealth there, most families do own a mobile phone, even though it may be shared between several people and may not be the latest model.
The research conducted indicated that Libyans would use m-Health if (a) it was implemented, (b) it was easy to use and (c) they knew that it existed. However, many of the answers suggested a lack of confidence that they would indeed know about it, presumably because the political situation in Libya, at the time the survey was conducted, was tumultuous. Practically speaking therefore, it would seem that penetration of the knowledge would be greater if healthcare providers imparted it, rather than it being left to the Libyan State.

The lack of a solid infrastructure was also seen as a major barrier to an effective m-Health implementation. Figure 5-3 explores the respondents’ answers in the form of a figure, which splits the Drivers and Barriers accordingly.

5.4 Age and Education Sample Bias

As 43% of the questionnaire respondents are studying or had obtained Bachelor’s degrees, and the 70% of them are aged between 18 and 34 years old, this sample cannot be considered representative of the Libyan population. This may have introduced some bias into the results as the majority of Libya’s residents have not achieved this level of qualification, and not all the majority of Libya’s resident’s age range between 18 and 34. This bias has been created as a result of the sampling method which started by emailing
the survey URL to final year medical students and internship graduates who then shared it with their colleagues and friends who are in a similar age range. The digital divide is a widely known issue in developed and developing countries alike. It is usually thought that younger people and those who have a higher level of education are more likely to adopt new technologies (Glied & Lleras-Muney, 2008), so these respondents could be considered the prime potential users of HIT systems. Therefore this does not invalidate the conclusions of this study.

5.5 Conclusion

This chapter was concerned with m-Health specifically in Libya. m-Health is a burgeoning area of healthcare with the potential to improve the health of many citizens in developing countries. This can range from everything from a patient's mobile phone advising him of the damage each cigarette is causing him to diagnosing serious illness and recommending immediate medical care.

In Libya, the position is that there is no m-Health whatsoever. Uncertain times, warring factions, political uncertainty and dissatisfaction with the current government in recent years mean that the introduction of ICT solutions are not seen as a real priority. There is no published research on attitudes to HITs within Libya and so the first phase is to gather some. The method chosen in gathering it was a survey examining what patients think of m-Health (proposed, not existing) in Libya. The survey has many limitations as a research method, and attempts were therefore made to validate all of the questions posed with fellow students from the University of Portsmouth before deploying it to the respondents. Some ambiguities were rectified as a result.

The survey (reproduced in full in Appendix B) is an ad-hoc survey. The questions posed derive from both the literature review and the assumptions made in creating the theoretical model which is at the heart of this research. The respondents were from many cities across Libya. Some of the results seem very surprising. For example, it is notable that the respondents were all educated professionals, and yet half of them had never even heard of computerised healthcare.

Respondents had some concerns about security but in the main were not worried in m-Health. They cited ease of use and lack of cost as being enablers in its use. These answers
correspond with published literature which suggests there is less fear of new technology than most governments believe.

The research was conducted to fill the gap in published research in relation to Libya and it could be used for further significant research into the development of HIT in general and m-Health in particular.
6 Exploring The Critical Success Factors and the Development of Version 2 of the Network of Influence Model (Study 2)

6.1 Introduction
The object of this chapter is to discuss the findings from exploring those factors critical to success in implanting HIT systems in developing countries. Exploring and critically evaluating these Critical Success Factors (CSFs) will help to construct the second version of the Network of Influence Model (NIM). As discussed, the original NIM was developed as a part of the literature review. However, a further study were conducted:

(a) in numerous developing countries, and
(b) from a broader perspective

may bring to light additional factors. An on-line survey (See Appendix C) was therefore distributed via Global Health Delivery Online, on-line forum of professionals focusing on the HIT systems in developing nations. The forum has, at time of the study, 22,027 members from 7,631 institutions across 185 countries in total.

The NIM is the centre of this thesis. Initially it was informed by the literature review, and later the analysis of the data collected from evaluating m-Health in Libya.

6.2 Methods

6.2.1 Pilot Survey
An informal pre-test phase was conducted prior to making the new survey available to the health professionals on the forum. The questions were discussed with the research supervisor and the survey was pilot-tested with 10 participants from the School of Computing at the University of Portsmouth, UK.

The aim of this was to check that the questions and the structure of the questionnaire were understood by the participants. The participants were asked to provide feedback on the questionnaire and the questions. The pilot test revealed that some questions
were slightly ambiguous and these were reworded appropriately before the actual study was conducted. The questionnaire questions for both the pilot and the actual study were in the English language.

6.2.2 Main Survey
This study used a survey eliciting both qualitative and quantitative data. The questionnaire was distributed via:

(a) e-mail to the Global Health Delivery Online (GHDonline) community, and

(b) social media tools WhatsApp and Viber Apps.

The social media programme was aimed at acquaintances and contacts who were asked to forward the URL of the survey to any health professionals they knew who may be able to assist.

The survey was available online for four weeks, from 31/10/2016 till 30/11/2016. The survey consisted of 49 questions: 45 of them were quantitative questions and 4 questions were open ended (free text fields) to capture qualitative data (see Appendix C). The settings in Survey Monkey were set up to permit only one response per computer. This was crucial as it helped to avoid duplication of responses.

The quantitative data was extracted to MS Excel 2013 and SPSS Version 22 to be analysed. Descriptive statistics were produced from the data; for example, percentages, mean and standard deviation (Janssens, De Pelsmacker, & Van Kenhove, 2008). The qualitative data was analysed thematically to extract any additional factors which may influence the implementation of HIT. Both quantitative and qualitative data were then used in the development of the second version of the NIM. Although we know the number of people who are members of GHDonline community, it was not possible to calculate the response rate because not all members of the community are working or familiar with HIT in developing countries. Hence not all of them will take part in the study. Another reason which makes it difficult to calculate the response rate is that we asked people to share the link with friends and colleagues outside GHDonline. This make
it impossible to know whether the 204 respondents are exclusively members of GHDonline or otherwise.

6.2.3 Reliability
Cronbach’s Alpha Test was used to conduct a reliability analysis. Cronbach’s Alpha Test reliability coefficient ranges between 0 and 1. The closer Cronbach’s Alpha coefficient is to 1, the greater the internal consistency of the item in the scale.

According to Gliem & Gliem (2003), a score greater than 0.7 is acceptable. The result indicated that the survey is acceptable and internally consistent, based on the overall score of 0.79.

6.3 Results

6.3.1 Demographics
The survey questions were designed to help gain an understanding of the participants who took part in the study. The analysis included the respondents’ age, gender, level of education, professional qualifications and country. A total of 204 responses were received.

6.3.1.1 Country
The 204 responses were distributed between 36 countries and the majority of them (n=199) were from developing countries. Even those who stated that they are from a developed country (n=5) reflected on their experience and involvement of implementing HIT systems in developing countries.
Figure 6-1 illustrates the name of the countries and the number of the participants from each country. Participants were from 36 countries; the vast majority of them were from Nigeria (n=16), followed by India (n=13) and Brazil (n=9). There was only one participant from each the following countries: Norway, Pakistan and Zambia.
6.3.1.2 Gender and Age

The majority of the participants were male (78%) as illustrated in Figure 2 below. Most of the participants represented the age groups between 25-34 (39%) and 35-44 (26%) as shown in Table 6-1 and Table 6-2.

Table 6-1 Age distribution of the survey participants.

<table>
<thead>
<tr>
<th>Age Spread</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-34</td>
<td>39%</td>
</tr>
<tr>
<td>35-44</td>
<td>26%</td>
</tr>
<tr>
<td>45-54</td>
<td>8%</td>
</tr>
<tr>
<td>55-64</td>
<td>14%</td>
</tr>
<tr>
<td>65 and Over</td>
<td>13%</td>
</tr>
</tbody>
</table>

Table 6-2 Gender distribution of the survey participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>159</td>
<td>78%</td>
</tr>
<tr>
<td>Female</td>
<td>45</td>
<td>22%</td>
</tr>
</tbody>
</table>

Participants were asked if any HIT systems were already implemented in their organisation. About three quarters of the participants indicated that there were HIT systems implemented, as shown in Table 6-3.
### Table 6-3 Implementation of HIT systems

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation of HIT systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>151</td>
<td>74%</td>
</tr>
<tr>
<td>No</td>
<td>53</td>
<td>26%</td>
</tr>
</tbody>
</table>

#### 6.3.1.3 Profession

Table 6-4 and Figure 6-2 show the distribution of professions. Academics and IT developers were in the majority.

![Professional distribution of the survey participants.](image)

Figure 6-2 Professional distribution of the survey participants.
Table 6-4 Professions distribution of survey participants.

<table>
<thead>
<tr>
<th>Profession</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>84</td>
</tr>
<tr>
<td>IT developer</td>
<td>59</td>
</tr>
<tr>
<td>Regulator</td>
<td>1</td>
</tr>
<tr>
<td>Healthcare manager</td>
<td>19</td>
</tr>
<tr>
<td>Admin staff</td>
<td>3</td>
</tr>
<tr>
<td>Physicians</td>
<td>23</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204</td>
</tr>
</tbody>
</table>

6.3.1.4 Level of Education

The results in Table 6-5 show the distribution of educational level of the survey participants, MSc holders had the highest number of respondents (71), this was followed by MD with 61 respondents. The participants holding Bachelor degrees or equivalent were 26.
Table 6-5 Level of Education of survey participants.

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>3</td>
</tr>
<tr>
<td>High School or equivalent</td>
<td>3</td>
</tr>
<tr>
<td>Bachelor Degree or equivalent</td>
<td>26</td>
</tr>
<tr>
<td>MSc or Equivalent</td>
<td>71</td>
</tr>
<tr>
<td>PhD</td>
<td>20</td>
</tr>
<tr>
<td>MD</td>
<td>61</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>204</strong></td>
</tr>
</tbody>
</table>

6.3.2 Organisational Readiness to Implement HIT Systems

This section of the survey dealt with the various issues about the readiness of healthcare organisations, based upon the findings of the literature review chapter of this thesis.

This section of the survey dealt with the various issues about the readiness of the healthcare organisations to adopt HIT systems. Moreover, addressing the factors which may influence the implementation of HIT in developing countries, some of these factors were identified during the literature review. Furthermore, some of these factors emerged from the analysis of the primary data during the various studies conducted through this programme; the source of the factors in the NIM were colour-coded.

Those which are considered enablers were coloured in green; those which are considered as barriers were coloured in red and finally those which were emerged from the primary data were coloured in green with different shape. A total of (n=204) participants responded to this section with no missing answers. Table 6-6 shows the results in more details. As the shaded cells in Table 3 depict, 50% of the respondents either agreed or strongly agreed that there is a defined and clear plan for implementing HIT systems’ development awareness in their organisation. On the other hand, just above half of the participants (51%) either strongly disagreed or disagreed that the equipment needed was available for all relevant staff members in their organisation.
Table 6-6 Organisations readiness and factors which could affect HIT systems implementation.

**To what extent do you agree or disagree with the following statements?**

Please think about your institution's role in facilitating implementation of HIT systems:

*Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Disagree = 5

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean*</th>
<th>SD</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a defined and clear plan for implementing HIT systems development awareness.</td>
<td>3.15</td>
<td>1.29</td>
<td>11.8%</td>
<td>26.5%</td>
<td>11.8%</td>
<td>34.8%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Equipment needed is available for all relevant staff members.</td>
<td>2.72</td>
<td>1.1</td>
<td>11.3%</td>
<td>39.2%</td>
<td>21.6%</td>
<td>22.1%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Proper motivation policies are applied.</td>
<td>2.4</td>
<td>1.03</td>
<td>21.6%</td>
<td>32.8%</td>
<td>32.4%</td>
<td>9.8%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Regulations &amp; rules are flexible enough to handle future developments.</td>
<td>2.63</td>
<td>1.14</td>
<td>20.6%</td>
<td>26.0%</td>
<td>26.0%</td>
<td>24.5%</td>
<td>2.9%</td>
</tr>
<tr>
<td>There are effective IT training programs.</td>
<td>2.59</td>
<td>1.14</td>
<td>21.6%</td>
<td>25.5%</td>
<td>27.9%</td>
<td>21.6%</td>
<td>3.4%</td>
</tr>
<tr>
<td>There is proper Local Area Network (LAN) to run all the organisation.</td>
<td>2.85</td>
<td>1.15</td>
<td>10.3%</td>
<td>35.3%</td>
<td>20.6%</td>
<td>26.0%</td>
<td>7.8%</td>
</tr>
</tbody>
</table>
To what extent do you agree or disagree with the following statements? Please think about your institution's role in facilitating implementation of HIT systems:

*Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Disagree = 5

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean*</th>
<th>SD</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>If a particular IT system is down, problems are resolved in a timely manner.</td>
<td>2.61</td>
<td>1.06</td>
<td>13.2%</td>
<td>38.2%</td>
<td>27.5%</td>
<td>15.7%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Computer software modules can easily be added to, modified, or removed from the existing IT infrastructure with minimal problems.</td>
<td>2.66</td>
<td>1.16</td>
<td>17.6%</td>
<td>34.3%</td>
<td>14.2%</td>
<td>31.4%</td>
<td>2.5%</td>
</tr>
<tr>
<td>We have IT personnel skilled in multiple technologies and tools.</td>
<td>2.94</td>
<td>1.15</td>
<td>12.3%</td>
<td>28.4%</td>
<td>16.2%</td>
<td>38.7%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Our IT department structure is integrated into the organisation structure.</td>
<td>2.82</td>
<td>1.15</td>
<td>12.3%</td>
<td>33.3%</td>
<td>20.6%</td>
<td>27.0%</td>
<td>6.9%</td>
</tr>
</tbody>
</table>

Moreover, 54% of the participants strongly disagreed or disagreed that their organisation is applying proper motivation policies to facilitate the implementation of HIT systems. Only 13% of the participants strongly agreed or agreed their organisation is applying proper motivation policies to facilitate the implementation of HIT systems.
The rest of the participants (32%) had a neutral opinion about the aforementioned issues. 46% of the participants strongly agreed or agreed that there were effective IT training programs through the organisation. Details are shown in Table 5-6.

About 50% of the respondents think that if a particular IT system is down, problems are resolved in a timely manner. In addition, just above half of the participants (52%) believe that computer software modules can easily be added to, modified, or removed from the existing IT infrastructure with minimal problems. Respondents were however, evenly divided when asked about the IT personnel skilled in multiple technologies and tools in their organisation. Almost 50% of the participants disagreed or strongly disagreed that IT department structure is integrated into the organisation structure. The following figure illustrates organisational readiness factors which could affect HIT implementation in developing countries in graphical form:

![Figure 6-3 Organisational readiness and factors which could affect HIT systems implementation.](image-url)
6.3.3 Level of Influence of Factors

Participants were asked to rate the importance of the factors identified from the literature review stage, using the following statement: “Using High (H), Medium (M) or Low (L), indicate the level of influence that each of the following factors listed below could have on the implementation of HIT systems in developing countries”.

The list of factors are shown in Table 6-7. The results show that all the listed factors were considered by the participants to have a high impact on the implementation of HIT. In addition, the results show that participants indicated that it is cost that has the highest level of influence on the implementation of the HIT systems. This result accords with the Lang et al. 2008 study which found that bespoke HIT systems may cost upwards of hundreds of thousands of dollars.

Only 11 participants from 204 stated that cost was considered to have a low impact on the adoption of HIT.

<table>
<thead>
<tr>
<th>Number</th>
<th>Factors/Level</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Academic contribution</td>
<td>24</td>
<td>36</td>
<td>144</td>
</tr>
<tr>
<td>2.</td>
<td>Awareness of HIT</td>
<td>8</td>
<td>48</td>
<td>148</td>
</tr>
<tr>
<td>3.</td>
<td>Brain drain</td>
<td>49</td>
<td>74</td>
<td>36</td>
</tr>
<tr>
<td>4.</td>
<td>Costs</td>
<td>11</td>
<td>20</td>
<td>173</td>
</tr>
<tr>
<td>5.</td>
<td>Cultural and social barriers</td>
<td>20</td>
<td>56</td>
<td>128</td>
</tr>
<tr>
<td>6.</td>
<td>Digital divide</td>
<td>13</td>
<td>55</td>
<td>136</td>
</tr>
<tr>
<td>7.</td>
<td>Geographical dispersion</td>
<td>7</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>8.</td>
<td>ICT Infrastructure</td>
<td>13</td>
<td>50</td>
<td>141</td>
</tr>
<tr>
<td>9.</td>
<td>IT skills</td>
<td>22</td>
<td>53</td>
<td>129</td>
</tr>
<tr>
<td>Number</td>
<td>Factors/Level</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------</td>
<td>-----</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>10.</td>
<td>Language barrier</td>
<td>46</td>
<td>83</td>
<td>75</td>
</tr>
<tr>
<td>11.</td>
<td>Legislation</td>
<td>34</td>
<td>45</td>
<td>125</td>
</tr>
<tr>
<td>12.</td>
<td>Organisational memory</td>
<td>19</td>
<td>100</td>
<td>85</td>
</tr>
<tr>
<td>13.</td>
<td>Political instability</td>
<td>39</td>
<td>72</td>
<td>93</td>
</tr>
<tr>
<td>14.</td>
<td>Power outage/ unreliability</td>
<td>9</td>
<td>56</td>
<td>139</td>
</tr>
<tr>
<td>15.</td>
<td>Resistance to change</td>
<td>19</td>
<td>59</td>
<td>126</td>
</tr>
<tr>
<td>16.</td>
<td>Standards</td>
<td>4</td>
<td>89</td>
<td>111</td>
</tr>
<tr>
<td>17.</td>
<td>Sustainability</td>
<td>14</td>
<td>32</td>
<td>158</td>
</tr>
<tr>
<td>18.</td>
<td>Technology acceptance</td>
<td>12</td>
<td>54</td>
<td>138</td>
</tr>
<tr>
<td>19.</td>
<td>Workforce capacity</td>
<td>3</td>
<td>67</td>
<td>134</td>
</tr>
</tbody>
</table>

Figure 6-4 illustrates the factors and their level of influence on the implementation of the HIT systems.
6.3.4 Identified barriers

In relation to barriers which could hinder the implementation of HIT, participants were asked to identify the extent to which they agreed that certain factors caused problems for developing countries’ HIT. This information is presented in Table 6-8.

The majority of participants agreed or strongly agreed that all the identified factors would be a major barrier. The vast majority (87%) agreed or strongly agreed that a lack of co-ordination among departments and organisations presented a substantive problem within their organisation.
Table 6-8 Factors which are considered by the participants to be barriers.

Please identify the extent to which you agree that the following factors cause problems at your organisation:

*Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Disagree = 5

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean*</th>
<th>SD</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Staff IT skills</td>
<td>3.89</td>
<td>1.01</td>
<td>0%</td>
<td>14%</td>
<td>11%</td>
<td>45%</td>
<td>30%</td>
</tr>
<tr>
<td>Staff resistance to change</td>
<td>4.12</td>
<td>0.90</td>
<td>0%</td>
<td>7%</td>
<td>15%</td>
<td>38%</td>
<td>41%</td>
</tr>
<tr>
<td>Lack of Political will and leadership</td>
<td>4.00</td>
<td>1.00</td>
<td>1%</td>
<td>9%</td>
<td>19%</td>
<td>33%</td>
<td>39%</td>
</tr>
<tr>
<td>Lack of Vision and strategy</td>
<td>4.16</td>
<td>0.84</td>
<td>0%</td>
<td>4%</td>
<td>17%</td>
<td>39%</td>
<td>40%</td>
</tr>
<tr>
<td>Lack of Co-ordination among departments and organisations</td>
<td>4.28</td>
<td>0.83</td>
<td>0%</td>
<td>5%</td>
<td>8%</td>
<td>40%</td>
<td>47%</td>
</tr>
<tr>
<td>Lack of Data privacy and security</td>
<td>3.79</td>
<td>1.12</td>
<td>2%</td>
<td>15%</td>
<td>20%</td>
<td>29%</td>
<td>34%</td>
</tr>
<tr>
<td>Lack of Technical infrastructure</td>
<td>4.17</td>
<td>0.85</td>
<td>14%</td>
<td>5%</td>
<td>7%</td>
<td>35%</td>
<td>39%</td>
</tr>
<tr>
<td>General attitude towards adoption of HIT systems</td>
<td>3.99</td>
<td>1.03</td>
<td>0%</td>
<td>4%</td>
<td>17%</td>
<td>38%</td>
<td>42%</td>
</tr>
<tr>
<td>Lack of Financial resources</td>
<td>4.21</td>
<td>1.08</td>
<td>2%</td>
<td>11%</td>
<td>12%</td>
<td>39%</td>
<td>37%</td>
</tr>
<tr>
<td>Lack of Internet connection</td>
<td>3.78</td>
<td>1.38</td>
<td>2%</td>
<td>12%</td>
<td>5%</td>
<td>27%</td>
<td>54%</td>
</tr>
</tbody>
</table>
Results in Figure 6-5 show that the most prevalent barrier to implementation of HIT is the lack of co-ordination among departments and organisations (87%), Internet connection (81%) and general attitude towards adoption of HIT systems (80%). Figure shows the information graphically.

6.4 Discussion

One of the purposes of this chapter is to explore the Critical Success Factors that could help to implement HIT successfully in developing countries. In addition, this chapter aims to update the first version of the NIM.
In this chapter, the identified findings of the literature and the analysis of the survey responses in relation to both qualitative and quantitative data, were synthesised and triangulated. The aim of this was to address and provide answers to the following research questions which were investigated during this study, namely research questions 3 and 5.

Although these questions have been answered in other parts of this thesis, this is to enrich the answers we provided.

**RQ3.** What factors influence the success or failure of the adoption of HIT in developing countries?

**RQ5.** What implementation metrics are being used in HIT projects in developing countries to measure success?

There were some limitations to the survey itself. To elicit as many responses as possible, mobile applications such as WhatsApp were used. General academic research that has compared the survey answers given using mobile and desktop applications indicates that respondents tend to answer free text field answers (of which there were 4) more succinctly if using a mobile device than a desktop one. There is the possibility therefore that more barriers do exist than I have included in Version 2 of the NIM.

More significantly, the research by necessity used a sample of respondents who were educated, had familiarity with ICT and were not illiterate. The qualitative data provided must therefore be seen in this context.

Initially data were analysed using statistical tools and then further using narrative synthesis. The results of the study played a key role in constructing Version 2 of the NIM.

### 6.4.1 Data saturation

When the process of the data analysis stopped leading to any new themes to emerge, this was when the data saturation had been reached and the researcher stopped looking
for more evidence in the data. Version 2 of the model is the final product of this research and it represents an example of building a theory using a case study research.

6.4.2 Version 2 of the Network of Influence Model

This version takes into account the CSFs we identified, and which our survey has proven to be valid. As mentioned in chapter 2, the purpose of carrying out both surveys was to identify the factors that may influence the development, implementation and adoption of HIT systems. Version 2 of the NIM is the final stage and is the modification of Version 1 according to an analysis of the new data in the second survey. See Figure 6-6.
The categories include 41 influential factors.

The 27 factors coloured in green are considered to be enablers. The 14 factors which are coloured in red are believed to be hindrances to HIT. As these factors were discussed at some length as part of the unveiling of Version 1 of the NIM, I will not go through them again. However, the four new factors that have emerged are briefly discussed here. These are also coloured green but with different shape, see Figure 6-6 (Version 2 of the NIM).

Please note that many of the respondents of the survey were writing in English, when English is not their first languages. In the analysis which follows, I have slightly amended some of the answers given by the respondents so that they are grammatically correct, whilst making sure not to change the point they were making.

This section analyses the qualitative data collected during the interviews with the benefit of transcription. Each interview was, initially, broken down into themes in order to identify issues that may affect HIT adoption in developing countries. Some of the themes identified were common to the first version of the model.

The following section discusses this process in more detail:

6.4.3 Analysis of the factors

6.4.3.1 Barriers

6.4.3.1.1 Political

The analysis of the data from the interviews showed the political situation does not seem to affect the introduction, development or implementation of any HIT projects in some developing countries. Instead, it is more commonly felt that political instability would be more likely to affect the whole HIT national programme.

This is due to the fact that political decisions are made at the top level of government policy. As one of the participants stated:
“The government [has] always embraced HIT initiatives, and there is a common belief in the potentials that HIT systems may offer. That is why the government is significantly committed to the program. This political belief is not only from senior politicians; it also exists among the lower managerial level.”

One noticeable factor considered to be the biggest challenge for some developing nations is political instability. Furthermore, political stability and economic advancement deeply influence each other. This because, when a country is stable, it leads to economic growth; on the other hand, unstable environment often means the country resources and organisations are mismanaged and misused. In turn, this means that the auditing bodies are unable to do their jobs.

In addition, when a country is politically unstable, local and foreign investment may be negatively affected. Investors will not feel comfortable investing in a country where the political atmosphere is full of uncertainty. The same applies to the healthcare sector. These factors can have a negative impact of the adoption of HIT in healthcare organisations as they part of the economic systems.

6.4.3.1.2 Organisational (Administrative and Contextual)

When a new technology is introduced without making the necessary changes to the previous work environment, an administrative barrier to its success can occur. In some cases, healthcare organisations struggled to handle the HITs that were introduced for this reason.

6.4.3.1.3 Resources

The reality of HIT projects in developing countries is that it is usually a small team of people computerising a small area of healthcare. The main costs are therefore the salaries of the programmers. These can often be prohibitive in developing countries.

There is very rarely an overarching state-sponsored ICT project, except when it is funded by the World Health Organization (WHO) or other international funders. Other HIT
projects depend upon funds from the State, and the State will be managing (and quite possibly micro-managing) its budget with both a target short term and target long term vision.

There has been some commentary on Open Source Solutions as a way of combating the high start-up costs of HIT projects. Indeed, where a grant has been awarded by an international funder to study a particular area of healthcare, some success in adapting these solutions without incurring high costs was reported (Fraser et al., 2012) using Open Source Solution OpenMRS.

6.4.3.1.4 Sustainability

This being so, one of the challenges that can face a developing country is the sustainability of the HIT it ultimately implements. A subsequent government may view the previous government’s spending on the maintenance of the HIT either as reckless, or simply too high for any benefits delivered. As pointed out several times already, if funding is withdrawn, the project will very quickly die.

6.4.3.1.5 IT Skills

Any HIT requires technical staff capable of building, testing, operating and maintaining its systems. One of the participants, who an IT project manager, stated:

“One of the most challenging barriers I have personally faced was the shortage of IT skills personal among the employees. In order for the project to be successful, a qualified and skilful staff to be able to start working towards the transformation of the manual work to electronic services [is required].”

Another participant stated:

"Lack of capacity in terms of trained staff to implement. Kenya education’s systems are yet to start any HIT training programs. Some do exist but are not efficient and depend on funding".
To overcome this barrier, it is recommended to hire graduates with Computer Science, Computer Engineering, and Information System backgrounds. Providing further training courses and professional workshops for employees, throughout the project life cycle, is also required.

6.4.3.1.6 Infrastructure and Technological:

There are several challenges that may affect the implementation of HIT systems through the different stages, from the technological infrastructure perspective. These challenges could include security concerns; this can be physical or logical security, as well as, the lack of standards and regulations. These barriers have been highlighted by the participants several times. One project manager said:

“When the project starts, infrastructure problems occurred. In the beginning, the technological infrastructural did not even exist. For instance, the access to the Internet was very slow and limited to particular departments, and the budget allocated to this was not enough. This affected the efficiency and the availability of the services”.

The digital divide is considered to be one of the challenges that developing countries face. The gap between the people who have access to the Internet and those who have not is very wide. This barrier may not affect the implementation of HIT systems, but it does affect the achievement of the objectives of their implementation.

The technological barrier was also seen as a future challenge, because if the population of a country is largely unfamiliarity with technology, this hinders any take-up of e-Health services. This barrier can be overcome if the government invests more in mobile-phone based systems.

Another technical factor is the interoperability. This can be seen as a barrier if HIT systems are to be adopted in developing countries for multiple services delivery. This is particularly the case if the HIT systems need to be integrated with other organisations.

Finally, and almost uniquely to the field of healthcare, is the factor of pharmacovigilance. Any HIT system that contains a database of pharmaceuticals should, ideally, guard
against bad practice when the state of medical knowledge about it has developed. If a
drug has been prescribed to a patient in the past with undesirable side effects, but
recent developments have resulted in a drug that can be prescribed without such side
effects, the HIT should suggest that the pharmacist treats the patient with the newer,
better drug accordingly.

6.4.3.1.7 Cultural Barriers

Cultural barriers are one of the main barriers developing countries face. The challenges
may start before the commencement of any e-Health projects and this may put the
initiatives at risk. For example, resistance to change from the different stakeholders
involved in introducing of HIT systems, whether they are services providers or recipients,
and particularly those who are not used to interacting electronically. This is because we
humans often fear to use things we are not used to. Often ordinary citizens have
negative views about anything electronic and would prefer to use a paper-based
approach.

Resistance to change is not only limited to citizens, but also common to policymakers
and governments. Furthermore, resistance to change was a common theme across the
two studies (m-Health in Libya and CSFs in developing countries), especially amongst
employees who either lack the required skills, fear doing something new or fear the HIT
will render their job redundant. In some cases, healthcare managers are also not very
keen to push for change. This is often due to two factors. The first is when managers are
not fully aware of the advantages IT systems can offer. The second is that, when
introducing new IT systems, and particularly those that monitor time-recording and
cash-flow, there may well be a financial disincentive to resist the change. This is because
bribery and corruption are usually endemic in developing countries, but the scale of such
corruption is hidden from the healthcare system alone by medical professionals
accepting money “under the table”. ICT can make this process more difficult. One
participant stated:
“When our organisation considered introducing a new IT system, some corrupt managers in the organisation were against the idea because they knew it would limit their income of unlawful cash. This approach was not only practised by the managers; some of the employees also managed to make extra income from the paper-based way of providing healthcare services.”

Another participant said: "Resistance from healthcare workers is to be expected as some of them feel their jobs are threatened"

Over the last decade there have been national and international efforts to combat corruption. For example, in 2005 the United Nations Anti-Corruption Convention entered into force; it has been considered the most powerful and comprehensive convention to fight an epidemic which is a very common practice in some developing countries.

Very few studies in the literature have addressed this factor in relation to its impact on the success or failure of HIT projects in developing countries. One of the participants stated “This epidemic sabotages the adoption of HIT in the first place”

In addition, awareness of the potential value which can be gained from adopting HIT systems is very low in some developing countries. Despite the fact that some healthcare providers have developed systems which are based on an online platform, some parts of their organisation, citizens and staff are not even aware of the web site where the electronic services are available, and in some cases they are not even aware such systems exist at all. It is not very promising when the citizens that these services are designed for, know nothing about them. Governments seem to not be doing enough to educate their citizens; a weakness of government performance.
6.4.3.2 Enablers

6.4.3.2.1 Legislative

In some cases, legislation can hinder the adoption of HIT systems. For example, Data Protection laws can prevent healthcare providers sharing data about their patients, even in cases where lives may be saved if such data is shared.

In other cases, legislation can be a driver rather than a barrier. Laws that protect the security of citizens’ data should, if respected, mean that only authorised persons are able to view the data, and it cannot be sold on or used for purposes that common sense would dictate it should not be used for.

6.4.3.2.2 Political Will

Based on most of the interviews, political will and support is one of the key driving factors to successfully implement HIT systems. Some countries have created initiatives for national projects to computerise healthcare delivery and have dedicated teams and significant budgets for these projects. This can be considered convincing evidence of embracing such initiatives.

One of the participants reflected on this and mentioned that this factor helped in overcoming several hinders which were encountered during the implementation of HIT projects, and stated the following:

“The Prime Minister and the Minister of Communications offered us their full support before and during the implementation of the national e-Health programme, and they requested us to inform them if we faced any resistance. They said they would do whatever they could to facilitate that. When the staff are aware that the programme implementation is mandatory and sovereign, any resistance to it can be reduced significantly.”

Another participant confirmed that a strong political commitment had a positive influence on the sustainability of a project:
“Support from top management was enabler number one, and this is one of the key things we need. This is because when we embark on institutional change, several problems will occur, and one common problem is resistance to change. To control the process and impose the transformation requires the willingness and commitment from upper management.”

This importance of this factor was also confirmed by another participant who was the director of the WHO e-Health programme in one of the developing countries:

“Definitely, with no exception, politicians from all levels, this including the ministers from the relevant ministries and even the Prime Minister were fully supportive of the e-Health National Project. This top support helped us to overcome hinderers, because these people were backing the potential value that IT offers. They saw it as the possibility to enhance the delivery of healthcare in the future. From implementing the previous projects, we learned something which was very helpful, if we had political sponsorship - for example, if a minister or the Prime Minister wanted to implement a particular project - all barriers are facilitated.”

6.4.3.2.3 Leadership

This factor was perceived by some of the participants as a very strong enabler and a key for the success of the transition of the healthcare services delivery through IT. This is because strong leadership can guarantee long term commitments through the different stages of a project. A good leader is one with the required technical knowledge, combined with cultural sensitivity and an awareness of the steps required to transform the old system to the new one. Most of the participants viewed this factor as a strong enabler, because they consider strong leadership is an extension to a strong political will. One participant stated:

“A good and strong leader should have full authority. He needs to be prepared to take risks, able to secure funds for the project, and embrace and advocate the penetration of HIT systems throughout healthcare institutions.”
6.4.3.2.4 Vision

The government in some developing countries has established a very clear vision and initiatives through which high quality healthcare services will be provided to the public. It has been perceived that this factor plays a very key role before even starting to invest in any HIT systems. Based on some responses from the participants in order for IT systems to be adopted in the healthcare sector, all of the stakeholders who are involved in the process need to have a profound and clear vision, and work towards the same goal. Furthermore, it is important that this vision is formulated co-operatively by all the stakeholders to ensure its success. One participant who worked as a project manager stated the following:

“Setting up a clear vision plan, as well as identifying its relevant objectives, and aligning the stakeholder’s version to that goal.”

Another project manager confirmed this and stated:

“It is important to begin the planning stage before starting a HIT project, through establishing a broad range of HITs in which the desired objectives are agreed and shared by all stakeholders.”

In answer to research question 5, there have been basic initiatives by some developing countries in introducing metrics to measure the success of HIT projects. Nevertheless, more work is needed in terms of measuring their success rate. For example, this can include using project management best practices. These are widely followed in many industrialised nations. An IT developer from Libya alluded to this in response to a question during an interview about the most common methodology which followed in Project Management:

“In Libya, projects are implemented in a very basic fashion, and a project can take a very long time to be finished. Often none of the internationally recognised Project Management techniques are adopted. In my opinion, this is down to the lack of knowledge about the existence of such approaches or techniques by the people who are
in charge of the projects. This can be overcome through updating the course’s curriculum in the higher education institutions as most of them currently are outdated. Additionally, organisations need to provide training courses to their employees in Project Management to enhance their knowledge and skills. These can be national and/or international courses”.

The mind map reproduced as Figure 6-7 attempts to capture the view of the participants who took part in this study in relation to the metrics used to measure success in HIT projects in developing countries.

![Mind Map](image)

**Metrics to measure success**

- If the system achieved the set goals
- Cost effectiveness
- Capacity for any alteration and scaling up
- If the system improved patient care
- Delivered on time and on budget
- The sustainability of the system
- Ease of use (Systems used by all end users, e.g. doctors, nurses, admin staff, patients)
- If system produced positive health results
- Increasing the productivity of all stakeholders
- Collaboration and interoperability

*Figure 6-7 Themes emerging from analysis of the interviews.*
Figure 6-7 illustrates the themes that emerged from the analysis of the data in response to the question about the metrics which are used to measure success. Respondents identified ten factors which measured if the HIT project was a success or failure.

The review of the previous literature on the success of HIT systems in developing countries from a multi-stakeholder’s perspectives have been very limited. Therefore, this thesis addresses this gap in the literature, this is achieved through the developed model.

6.5 Conclusion

This chapter describes the results from the survey. The survey was designed to capture both quantitative and qualitative data. Overall, these results offered meaningful insights into the issues and opportunities related to the HIT systems implementation in developing countries. The data collected from the survey was also tested for reliability using the Cronbach’s Alpha Test and it was found to be quite consistent. These results will also be discussed in the next chapter in relation to validation of the developed model.

Furthermore, a second version of the NIM has been developed which consisted of the eight categories. The model can used in adopting HIT in developing countries, and hopefully it will contribute towards the chance of success and, as a result, large sums of money can be saved.

The next stage will be to validate the NIM using a modified Delphi study approach to measure the robustness of the developed model. However, the framework needs to be tested and validated significantly using a prototype through one applications of the HIT systems, for example EMRs in a particular country.
7 Validation of Research Findings (Study 3)

7.1 Introduction
In the previous two chapters (Chapters 4 and 5), findings from the analysis of each case and the cross case analysis were presented and discussed. The relationships between major factors and/or categories were also examined. Based on the analysis, the developed model was modified.

This chapter addresses a key stage of this research programme which is to validate the developed model. It discusses the procedures and measures adopted to ensure the quality and rigour of the findings of this research. This was achieved by adopting some common approaches which confer rigour on data analysis and how they were adopted in this research programme. These approaches are purposive sampling, multiple coding and respondent validation (Barbour, 2001).

The rest of this chapter is organised as follows: section 2 discusses Purposive Sampling, section 3 discusses Multiple Coding and section 4 discusses Respondent Validation. Also, an explanation of how these strategies were used particularly in this research is given. Due to its relative importance, respondents’ validation has been given special emphasis in this research. The purpose of these sections is to validate each of the following: the identified factors, groups and their relationships, and finally a validation of the model prototype. The chapter then concludes with a summary.

7.2 Methods
This study adopted a modified Delphi approach to validate final version of the model through a panel of 15 experts in the field of HIT from both developed and developing countries that are suitably knowledgeable regarding the HIT implementation. A web based-survey was developed using Survey monkey (http://www.surveymonkey.com). The participants were sent the survey in rounds one and two. Consensus was defined as 80% agreement between participants on questions requiring a single response. Although consensus was not reached on all questions following two Delphi rounds, response stability was apparent after two rounds, making it unlikely that participants would change views during a third round.
7.3 Results

7.3.1 Demographics

Fourteen participants helped in the validation of the model. It should be noted that all these data were collected via online questionnaires, as it was not possible for the researcher to travel to the different countries where each participant was based to conduct the interviews in person. Table 7-1 lists all participants involved in the validation process along with their positions, the total number of years of work experience, age, and gender.

Table 7-1 participant’s information took part in the model validation

<table>
<thead>
<tr>
<th>Position</th>
<th>Number of years of experiences</th>
<th>Age</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician and chair of HL7 Brazil</td>
<td>20+</td>
<td>56+</td>
<td>Male</td>
</tr>
<tr>
<td>Chief medical informatics officer</td>
<td>11-15 years</td>
<td>34-41</td>
<td>Male</td>
</tr>
<tr>
<td>Clinical informatician</td>
<td>Over 20 years</td>
<td>56+</td>
<td>Male</td>
</tr>
<tr>
<td>Health care standards architect</td>
<td>16-20 years</td>
<td>56+</td>
<td>Male</td>
</tr>
<tr>
<td>PHP developer</td>
<td>6-10 years</td>
<td>34-41</td>
<td>Male</td>
</tr>
<tr>
<td>eHealth consultant (focused on low and middle income countries)</td>
<td>16-20 years</td>
<td>42-49</td>
<td>Male</td>
</tr>
<tr>
<td>Hospital administrator</td>
<td>16-20 years</td>
<td>42-49</td>
<td>Male</td>
</tr>
<tr>
<td>Director of technology transfer and</td>
<td>20+</td>
<td>50-54</td>
<td></td>
</tr>
</tbody>
</table>
Furthermore, this section demonstrates how the collected data was analysed and how the themes emerged, using exemplar quotations and linking them to some of the factors which constitutes the network of influence model.

7.3.2 Some of The Emerged themes

7.3.2.1 Costs

![Figure 7-1 illustrates theme A.1](image-url)

7.3.2.2 Sustainability And Running Costs
7.3.2.3 Technological Infrastructure

"If the system is to be "Internet-based", then it makes sense to ascertain whether the Internet connection is reliable enough. If not, then it may not make sense to incur any costs at all as two systems (the old paper-based and the new Internet-based) would have to be run at the same time. However, THIS IS NOT NECESSARILY A REASON TO ABANDON A HIT IMPLEMENTATION. By all means, the project can be started based on the assumption that, "before rollout" the technological infrastructure will have been improved. Indeed, this may prove beneficial as may mean that stakeholders have the correct expectations of the HIT, rather than unrealistic ones."

"Technological infrastructure is the base of the HIT pyramid"

"Broadband speed limitations, overprice and monopoly are huge barriers"

7.3.2.4 Corruption
7.3.2.5 Technology Acceptance

"The acceptance/adoption of technology by the community in developing countries is not inherent - it depends on access and equity across the digital divide."

"People admire and prefer advanced technology; they do not dislike and reject it."

"Regulation can cause change to happen whether they like it or not."

7.3.2.6 Geographical Dispersion
7.4 Purposive Sampling

The purposive sampling strategy depends on the judgement to select cases very close to the research questions and objectives. The samples tend to be very small and are very convenient for case study research (Shaw, 1999). While the logic of probabilistic sampling lies in selecting a random and representative sample which will permit confident quantitative generalisations from the sample to a larger population (Patton, 2002), the logic of purposive sampling is suited to research with different aims. Its power lies in the selection of cases rich in qualitative information about the substantive research problem.

In considering the organisations involved in the research, it was decided that purposive, rather than random, sampling would be an effective way of selecting different cases studies rich in data pertinent to understanding the research problem (Marshall and Rossman, 1995). As such, purposive sampling was suited to developing a comprehensive understanding of the development and implementation of HIT projects in the Libya particularly and developing countries generally.
Rather than aspiring to statistical generalisability or representativeness, this research chose to reflect diversity within HIT implementation in developing countries. Many qualitative researches often rely on convenience samples, particularly when the group of interest is difficult to access (Barbour, 2001). The reason is that the definition of the research cases is limited (the research is only interested in the implementation of HIT systems within the context of developing countries). Furthermore, it allows us to choose the cases. Such selection of case studies helped to control variation and define the limits for generalising the findings.

7.5 Multiple coding

Multiple coding is a valuable strategy in validating the findings of qualitative research (Barbour, 2001). Multiple coding was used to overcome any subjectivity that might have been introduced during the process of qualitative data analysis. Independent researchers and colleagues were asked to cross-check the coding strategies and the interpretation of data adopted during data analysis. This was also a core activity of many supervision meetings. However, multiple coding did not include a complete replication of results. It was useful for the researcher to have other people’s opinions over segments of data and emergent coding frameworks.

Substantial agreement was found with some of the researchers who independently reviewed the coding of selected interview transcripts. Some slight variations were found in the ways that they grouped the codes and the vocabulary used. We considered these variations to be common (as long as they were not significant) given the complexity of qualitative data and the range of disciplinary backgrounds and interests of qualitative researchers. In addition, we considered the degree of disagreement between researchers was not significant, in relation to the content of disagreements and the insights that the discussion with them provided for refining coding frames. Another benefit from adopting multiple coding is that it provided alternative interpretations and alerted us to other potentially competing explanations. This process encouraged thoroughness, both in interrogating the data at hand and in providing an account of how an analysis was developed.
In addition to checking the coding strategies with independent colleagues, we were keen to debrief the analysis and conclusions to colleagues and other peers on a continuous basis. This process was pursued in various numerous forms. For example, by discussing the emerging findings with knowledgeable colleagues to stimulate consideration and exploration of additional perspectives and explanations at various stages of the process of data collection.

7.6 Respondent Validation

The final technique we used to validate the findings of this research was respondent validation. The use of respondent validation helps to ensure stability. Checking the results on completion of data collection, or of the whole study with the respondents, would meet the requirements of reliability (Long and Johnson, 2000). Using this technique, we cross checked the research findings with some official seniors from the selected international organisations, for instance: WHO and HL7 International whose reactions to findings helped refine explanations – as did those of the key informants. Their opinions were considered as further interpretations and suggestions for improvements in explaining the findings.

7.7 Methodology for Respondent Validation

The respondent validation process was undertaken after the model was developed. We tried to contact the respondents as soon as the data analysis and development of the findings were completed to avoid the problems of lack of access, or alteration of the respondents’ situation.

Five interviews were subjected to respondent validation. It should be noted that all these interviews were conducted via teleconferencing, as it was not possible for the researcher to travel to the different countries where each participant was based to conduct the interviews in person. (Table x) lists all interviewees involved in the validation process along with their positions, their organisations, and the total number of years of work experience.
7.8 Validation of the Factors and relationships

7.8.1 Validation of the Model Prototype

The development of the version 1 of the conceptual model in this research was based on existing literature validated models and frameworks and the actual experiences of implementing HIT in some developing countries. The modification of the model was done by conducting a study to explore the Critical Success Factors which may influence the implementation of HIT in developing countries. According to the new data collected and their analysis, it was imperative to validate the model through the different phases of the model development.

7.9 Chapter summary

In this chapter, the approaches used were explained to ensure the quality and rigour of this research’s findings and the usefulness of the developed model. This was firstly achieved by discussing the strategies and measures adopted to conduct such validation, and explaining what their output was. The validation strategies used in this research are: purposive sampling, multiple coding, and respondent validation.

Concerning the respondent validation strategy, an explanation of its process was given in addition to the details of the validation sessions and interviews. These sessions aimed to, the identified factors, groups and their relationships, and finally a validation of the model prototype.
8 Discussion and Conclusions

8.1 Introduction

At first glance, the failure rate of ICT projects in developing countries is so high that
governments may be tempted to give up before they even start. In addition, when even
academics have difficulty defining what constitutes a success and a failure, any thesis
that attempts to distil the myriad perspectives and factors into a model can only ever be
the tip of the iceberg.

In a very real sense, it is the lack of published information as to why ICT projects have
failed in developing countries that is precisely the problem. Every failed project is a
goldmine of knowledge as to what the factors were that resulted in its collapse. It is
almost inexcusable that this knowledge goes to waste, and, as a direct result, the same
mistakes are quite probably made time and time again.

Lest we get too depressed however, it is probably worth considering that many
developed countries face exactly the same problems as developing ones - lack of funds,
lack of trained staff and endemic corruption are not unique to developing countries. The
NIM too is also not specific to developing countries; and it applies just as equally to all
ICT projects as it does to healthcare ones.

8.2 Discussion of the Literature Review

The literature review informed the research, and it would therefore have been odd if
the NIM itself did not agree with it. It does. The most important use of the literature
review in respect of this thesis was the gap which it identified. The gap identified is the
lack of a theoretical model which takes into account multi stakeholder’s perspective in
the planning, implementation and evaluation of a ICT systems.

This research makes a somewhat bold attempt to fill that gap by deriving as much
knowledge as possible from the research that can be found. It then goes on to use that
research in the formulation of the NIM. There are however, some stark differences
between the NIM and some of the prior research. One might argue that the NIM, for
example, is an extension of DeLone and McLean’s 1992 TAM model, but one could as easily argue that it is in direct contradiction to it. In a way this is to be expected because the NIM looks at an ICT project from not just a different perspective but many different perspectives.

For detailed discussion of the literature review, please refer to heading 2.3.3.

8.3 Existing Models Related to HIT
Ahlan and Ahmad (2015) attempted to address the success or failure of ICT systems by devising the Technology Acceptance Model (TAM) (See Figure 2 - 10). The model places the evaluation of the ICT system at its heart, and addresses each of the factors that impact whether or not it is accepted by the end users. The model is useful as it addresses stakeholder perception and involvement in developing a project. However, I would argue that it is difficult to strictly apply it to HIT. This is not because the model has no application at all. Rather it is because the end-users envisaged by the model are clearly those who are familiar with all aspects of the system’s design and cost-effectiveness.

In the case of HITs, the end users would therefore be the medical professionals. The model is silent in regard to the healthcare patients themselves; their perceptions and involvement in the HIT would not be considered, and they would not be in possession of some of the information which would impact upon the evaluation of success or failure.

8.4 Discussion of the Research Objectives and the Research Questions
It did not prove possible to answer all of the Research Questions. Those that were answered were detailed throughout the thesis. It was my original intention to answer to what extent HIT systems were deployed in Libya and what implementation metrics monitored their success and failure rate.

Sadly, some this information simply is not available; even, it seems, to the extent that those who have been involved in HIT projects within Libya are unsure as to why a project succeeded or failed.
This being the case, I cannot make the practice and policy recommendations that I originally wanted to. Some broad themes can of course be drawn from the model itself but it would be somewhat reckless to assert with authority what factors might require more or less importance specifically in Libya. This does not lessen the impact of the research and the model produced however. It merely indicates the need for comprehensive research in this area so that the model can be considered in the light of it. Table 8-1 (below) illustrates the research questions and the research strategy adopted. Additionally, the table depicts the overall findings achieved in relation to each one.
Table 8-1 shows illustrates the research questions, the research strategy adopted and the overall findings

<table>
<thead>
<tr>
<th>Research question</th>
<th>Research strategy adopted</th>
<th>Overall findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>What distinct factors should be taken into consideration when HIT projects are</td>
<td>Literature review</td>
<td>There are several factors which developing countries need to take into account when implementing HIT systems.</td>
</tr>
<tr>
<td>implemented in developing countries compared to developed countries?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To what extent has HIT been deployed in developing countries?</td>
<td>Literature review</td>
<td>Health information technology are widely adopted in many developing countries.</td>
</tr>
<tr>
<td>What factors influence the success/failure of the adoption of HIT in developing</td>
<td>Case study research and Online survey</td>
<td>There are considerable number of factors which influence the adoption of HIT systems in developing countries.</td>
</tr>
<tr>
<td>countries?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To what extent have HIT systems been deployed in Libya?</td>
<td>Case study research method using online survey and semi-</td>
<td>Unfortunately, some of this information is not available; even, it seems, to the extent that those who have been involved in HIT projects within Libya are unsure as to why a project succeeded or failed.</td>
</tr>
<tr>
<td></td>
<td>structured interviews.</td>
<td></td>
</tr>
<tr>
<td>What implementation metrics are being used in HIT projects in developing countries to measure success?</td>
<td>Case study research using online survey and semi-structured interviews.</td>
<td>Few metrics were identified.</td>
</tr>
</tbody>
</table>


8.5 Attempts to Recurring Libyan Officials

Since Libya suffered extensively as a result of the 2011 war, we thought it would be useful to get some insights and understanding of how the Libyan Ministry Of Health managed the situation during the war in 2011. In particular, we were interested in considering the large number of casualties and lack of access to healthcare facilities during that time. We made several attempts to contact some of the officials who were in charge of health affairs during that time. Unfortunately neither the Minister for Health during the war nor the Minister for Health post-war responded to our e-mails. Had we been able to follow up on this line of investigation, we would have attempted to see whether any lessons could be learned.

8.6 Personal Reflection/Evaluation

This thesis is an academic work, and those involved in delivering healthcare services are professional people. Doctors and medical professionals are highly educated, whilst the modern application developer is usually skilled in many computer languages and methodologies for Project Management and, of course, delivery. What comes across in the responses from all the participants in Study 2 was the high level of frustration that they felt, having been involved in projects that, for one reason or another, had not come to fruition due to what they perceived as "external factors".

What I have learned from conducting this research is simply that there are no "external" factors. If there is no funding, or if funding is pulled, any ICT project will immediately cease to be. But all other factors can be considered integral to the success or failure of the project per se.

Because of the complexity of factors involved, it is also clear to me that experience is not necessarily a good indicator of lessons learned.

8.7 Research Limitations

Attempts were made to minimise any potential limitations of this research programme by applying rigorous scientific approaches to them. However, there some possible limitations of this research which are summarised as follows:
• Due to time and fund constraints, all the interviews were carried out using teleconferencing. This may have influenced and affected how the participants responded to some of the questions. This could have been done differently, for example, face to face interviews.

• Some sample bias will have occurred in the process of respondents’ recruitment for the interviews due to the approach used. E.g. personal contacts convenient contacts, etc.

• It is very difficult to conduct research in a country where (a) policymakers are unaware of the benefits of an ICT healthcare solution, (b) corruption is widespread and (c) the country itself is unstable. It is possible that respondents were more guarded in their responses to some questions, possibly out of fear that, in the hands of the Libyan State, their responses might be deemed controversial enough for some sanction to be applied.

8.8 Contributions to Knowledge

8.8.1 Implications of the Research

This research has made a significant attempt to identify factors which may influence the implementation or the adoption of Health Information Technology systems in developing countries.

It is the first study to investigate and evaluate the current status of Health Information Technology in Libya. Furthermore, it has produced two models, NIMs Versions 1 and 2 which address the limitation of previous models that attempted to model the implementation of HIT in developing countries.

A large body of the research into IT project failure begins by stating that the first step should be to identify the stakeholders and to elicit their opinions on the proposed IT solution.

The developed NIM dispenses with the perceived wisdom to identify stakeholders. Instead, it posits the theory that the stakeholders’ perceptions can be equally modelled and presented. This therefore leads to a quicker understanding, if the model is used
correctly, of where it might be that the identified stakeholders' perceptions will conflict. The research contribution consists of two parts: a theoretical implication and a practical one. These are illustrated in the following sections.

8.8.1.1 Theoretical Implication

The theoretical implication is that diagrammatically presenting the information will assist the management of the ICT solution, leading to a lower rate of failure in those projects that use it. Ideally, the model would be used before the commencement of programming; it could also be used in the early stages to gather system requirements and Version 2 of the NIM should also give some guidance to policymakers and ICT managers of the concerns any particular stakeholder would have. It should also allow an ICT manager to answer many of the questions stakeholders may pose.

An additional theoretical consideration is to consider both versions of the NIM as a starting point in analysing a current HIT solution either being proposed or already in existence in a developing country. In addition to the wide-ranging literature review, the two surveys expose new information which can be used to fill the gaps that were identified. Combining the theoretical assumptions in the NIM with the practicality of a HIT solution would, and should, aid the development of Information Technology in a developing country.

8.8.1.2 Practical Implication

The NIM is completely an innovative contribution to the study of HIT in Libya and developing countries. In relation to the lack of resource, knowledge and skills in developing countries, governments in these countries need this kind of guidance. The model identifies eight main categories which developing countries need to address when implementing HIT systems. (See the 5.4.2 and 5.4.3).

The practical implications have already been touched on throughout the body of the text. If the above theory is correct, then the model will demonstrably, and positively,
impact the delivery of an ICT solution. It will lead to realistic expectations of the system, as well as guide design processes (for example, clearly a "mobile-first" approach should be taken to any developing countries e-Health HIT services). Additionally, the two models can also be used to independently evaluate a HIT service.
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Appendixes
Appendix A: The Ethical Approval

Certificate of Fast Track Ethics Review

<table>
<thead>
<tr>
<th>Project Title:</th>
<th>Exploring critical success factors for health IT in low and middle income countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Number:</td>
<td>537824</td>
</tr>
<tr>
<td>Application Date:</td>
<td>09/04/2014 13:48:13</td>
</tr>
</tbody>
</table>

You must download your referral certificate, print a copy and keep it as a record of this review.

You should submit your certificate to your FEC representative for further review.

The FEC representative for the School of Computing is Carl Adams

It is your responsibility to follow the University Code of Practice on Ethical Standards and any Department/School or professional guidelines in the conduct of your study including relevant guidelines regarding health and safety of researchers including the following:

- University Policy
- Safety on Geological Fieldwork

It is also your responsibility to follow University guidance on Data Protection Policy:

- General guidance for all data protection issues
- University Data Protection Policy

ProjectTitle:
Exploring critical success factors for health IT in low and middle income countries

SchoolOrDepartment:
SOC

PrimaryRole:
PostgraduateStudent

SupervisorName:
Dr Philip Scott

HumanParticipants:
Yes

HumanParticipantsWarning
ParticipantInformationSheets:
Participants will be given information sheets and asked for informed consent.

ParticipantConfidentiality:
Interview recordings and notes will be saved anonymously in the researchers secure area on the university network.

Certificate Code: 0EB4-A239-CB3A-4BB7-EC11-6461-8B48-9D1D  Page 1 / 2
InvolvesNHSPatientsOrStaff: No
NoConsentOrDeception: No
InvolvesUninformedOrDependents: No
DrugsPlacebosOrOtherSubstances: No
BloodOrTissueSamples: No
PainOrMildDiscomfort: No
PsychologicalStressOrAnxiety: No
ProlongedOrRepetitiveTesting: No
FinancialInducements: No
PhysicalEcologicalDamage: No
HistoricalOrCulturalDamage: No
HarmToAnimal: No
HarmfulToThirdParties: No

**Supervisor Review**
Supervisor signature: 
Date: 9/4/14

**Review by FEC Representative**
Name of representative: 
Comments: Follows informed consent principles - ok,
Representative signature: 
Date: 2/4/14

Certificate Code: 0EB4-A239-CB3A-4BB7-EC11-6461-8B48-9D1D
Appendix B: Study 1: HIT in Libya with special focus on mHealth

### Mobile services to support healthcare delivery in Libya: Opportunities and challenges

1. In which city do you live?

2. What is your profession/role?

3. What is the highest level of education you have achieved?
   - [ ] Less than High School
   - [ ] High School or equivalent
   - [ ] Bachelor degree or equivalent
   - [ ] MSc
   - [ ] PhD
   - [ ] Other

4. Do you own a mobile device?
   - [ ] Yes
   - [ ] No

5. What kind of mobile device do you own?
   - [ ] Basic phone
   - [ ] Smart phone

6. Do you have access to the Internet in your device?
   - [ ] Yes
   - [ ] No

7. How much does it cost you monthly to use the Internet?
8. Does the cost limit you from using the Internet?
   ○ Yes
   ○ No

9. What do you use your mobile device for the most often?

10. Have you ever used your mobile device to access information about your health?
    ○ Yes
    ○ No

11. What did you use it for:
    ○ Booking an appointment
    ○ Getting lab results
    ○ Updating my health records
    ○ Other(Please specify)

12. Did you find it easy to use?
    ○ Yes
    ○ No

13. The cost of owning a mobile device is quite high:
    ○ Yes
    ○ No

14. What could encourage you to use your mobile to access to your health information?

15. What could discourage you to use your mobile device to access to your health information?
16. Have you heard of mHealth before this questionnaire?

17. How do you feel about health organisations holding your data electronically?

18. Mobile health applications are less time consuming and more convenient than going to health facilities.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Don't Know</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

19. mHealth will reduce unnecessary hospital visits and waiting time

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Don't Know</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

20. People are aware that mobile devices applications can be used to improve healthcare.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Don't Know</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

21. Who do you think will benefit most from the use of mobile devices in healthcare?

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Don't Know</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
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<tbody>
<tr>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

22. In your opinion, what factors that might effect the implementation of mHealth services in Libya?


23. What is your gender?

   □ Male
   □ Female
24. Please select your age group

○ 18-24  ○ 45-54
○ 25-34  ○ 55-64
○ 35-44  ○ 65+

25. We are planning to conduct interviews (via phone, Skype). Would you be willing to take part?

○ Yes
○ No

26. Please write your name and contact details below if you are willing to be interviewed; Your contact details will not be disclosed, they will only be used for facilitating the interview.


27. If you have any other comments, questions, or concerns, please state here.


Thank you, those are all of the questions we have for you. We sincerely appreciate your time and participation in this study.
Appendix C: Study 2 exploring the CSFs of implementing HIT in developing countries survey.

Exploring the critical success factors (CSFs) influencing the implementation of health information technology systems in developing counties.

1. In which country you are based?

2. In the country where you are based what is the main motivation for implementing HIT systems?

3. What are the main barriers to implementing HIT systems in the country where you are based?

4. To what extent do you agree or disagree with the following statements? Please think about your institution's role in facilitating implementation of HIT systems.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a defined and clear plan for implementing HIT systems development awareness.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Equipment needed is available for all relevant staff members.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Proper motivation; policies are applied.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Regulations &amp; rules are flexible enough to handle future developments.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>There are effective IT training programs.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

If you would like to explain or qualify your answers for this question, please state here:
5. If you would like to explain or qualifying your answers for this question, please state here:

6. To what extent do you agree or disagree with the following statements? Please think about your institution’s role in facilitating implementation of HIT systems.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is proper Local Area Network (LAN) to run all the organisation.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If a particular IT system is down, problems are resolved in a timely manner.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Computer software modules can easily be added to, modified, or removed from the existing IT infrastructure with minimal problems.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We have IT personnel skilled in multiple technologies and tools.</td>
<td>○</td>
<td>○</td>
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<td>Our IT department structure is integrated into the organization structure.</td>
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7. If you would like to explain or qualifying your answers for this question, please state here:


8. Using High (H), Medium (M) or Low(L), indicate the level of influence each of the following factors listed below could have on the implementation of HIT systems in developing countries.

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<tr>
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<td>Power outage/unreliability</td>
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<td>Workforce capacity</td>
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9. If you would like to explain or qualifying your answers for this question, please state here:

[Blank space for explanation]

196
10. Please identify the extent to which you agree that the following factors cause problems at your organisation:

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<tr>
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11. If you would like to explain or qualify your answers for this question, please state here:

[Blank space]

12. Is there any HIT system(s) implemented at your organisation?
   - ○ Yes
   - ○ No

13. In relation to the HIT system(s) that has been implemented within your organisation, how successful is this project in your opinion?
   - 1 Very Successful
   - 5 Very unsuccessful
   - Please rate ○ ○ ○ ○ ○

14. In your own words, please define what constitutes success or failure of a HIT system.

[Blank space]
21. Which of the following categories best describes your profession/role, please tick as appropriate.

○ Academic  ○ Medical student
○ Admin staff  ○ Regulator
○ Healthcare manager  ○ Physician
○ IT developer  ○ Other (please specify)
○ Other (please specify)

22. If you have any other comments, questions, or concerns about the implementation of HIT systems in developing countries, please state here.
Appendix D: Study 3 validation of research findings survey

Investigating the critical success factors influence the implementation of health information technology in developing countries.

Thank you for agreeing to participate in our Delphi study. This study forms a part of the validation of a critical success factors (CSFs) model which has been produced to support the implementation of health information technology in developing countries. This questionnaire is the first of two during the study. Please try to answer all questions.

Once we have received responses from all panellists, we will collate and summarise the findings and formulate the second questionnaire. An email will be sent to inform you once the subsequent question has been released for completion.

We assure you that your participation in the study and your individual responses will be strictly confidential and will not be shared with anyone outside the research team.

The questionnaire should take approximately 10 - 15 minutes to fill out.

Should you have any questions about the study, please contact the primary researcher, Haythem Nakkas, using the below email address.

Kind regards,
Haythem Nakkas

Email: haythem.nakkas@port.ac.uk
* 1. In which developing country are you involved in providing or developing health information technology (HIT) systems? If you are involved in more than one developing country, please list them in question 2 of this survey.

2. If you are involved in more than one country please list them here:

* 3. Below is a list of factors which may influence the implementation of HIT in developing countries, based upon a comprehensive literature review and analysis of primary research data. Please state how important you think they are for HIT implementation to be successful, 1 indicates *least important* and 5 indicates it is *most important*.

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<td>29. Workforce capacity</td>
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Investigating the critical success factors influence the implementation of health information technology in developing countries.

* 4. If we had to choose the five most critical factors, which ones from the previous list of the 29 would you select? Please rank what you believe to be the top 5 factors and give your reason for this ranking.

(Ignore the rows that you think are not in the top 5)

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* 5. If we had to choose the **five least critical factors**, which ones from the previous list of the 29 would you select? Please list up to 5 factors from the previous list of 29 that you think they could be excluded and give your reason for this ranking.

(Ignore the rows that you think are not in the least important 5)

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6. If you found the meaning of any of the factors confusing or unclear, please use the provided space to qualify that.

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Investigating the critical success factors influence the implementation of health information technology in developing countries.

7. If you think there are any missing CSFs from the previous list, and they could be important for implementing HIT successfully in developing countries. Please explain them here and indicate if you think any of them are more critical than the 5 you gave us before.
8. What is your job role?

9. Please state your years of experience:
   - 1-5 years
   - 6-10 years
   - 11-15 years
   - 16-20 years
   - Over 20 years

10. What is your gender?
    - Male
    - Female

11. Please indicate your age range:
    - 18-25
    - 26-33
    - 34-41
    - 42-49
    - 50-54
    - 56 and over
12. If you want to add any extra information in relation to the CSFs implementing of HIT in developing countries, please explain here:
Investigating the critical success factors influence the implementation of health information technology in developing countries.

Thank you, those are all of the questions we have for you. We sincerely appreciate your time and participation in this study.
Appendix E: FORM UPR16

FORM UPR16
Research Ethics Review Checklist

Please include this completed form as an appendix to your thesis (see the Postgraduate Research Student Handbook for more information)

<table>
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<th>Postgraduate Research Student (PGRS) Information</th>
<th>Student ID:</th>
<th>488011</th>
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<tbody>
<tr>
<td>PGRS Name:</td>
<td>Haythem Nakkas</td>
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<td>Department:</td>
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<td>First Supervisor:</td>
<td>Dr Philip Scott</td>
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<td>Start Date: (or progression date for Prof Doc students)</td>
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Study Mode and Route:  

- [ ] Part-time  
- [x] Full-time  
- [ ] MPhil  
- [ ] PhD  
- [ ] MD  
- [ ] Professional Doctorate

Title of Thesis:  

Constructing the Network of Influence Model: an evidence-based theoretical framework to improve the implementation of Health Information Technology in developing countries.

Thesis Word Count:  

33453 (excluding ancillary data)

If you are unsure about any of the following, please contact the local representative on your Faculty Ethics Committee for advice. Please note that it is your responsibility to follow the University’s Ethics Policy and any relevant University, academic or professional guidelines in the conduct of your study. Although the Ethics Committee may have given your study a favourable opinion, the final responsibility for the ethical conduct of this work lies with the researcher(s).

UKRIO Finished Research Checklist:  

(If you would like to know more about the checklist, please see your Faculty or Departmental Ethics Committee rep or see the online version of the full checklist at: http://www.ukrio.org/what-we-do/code-of-practice-for-research)

a) Have all of your research and findings been reported accurately, honestly and within a reasonable time frame?  

- [ ] YES  
- [x] NO

b) Have all contributions to knowledge been acknowledged?  

- [ ] YES  
- [ ] NO

c) Have you complied with all agreements relating to intellectual property, publication and authorship?  

- [ ] YES  
- [ ] NO

d) Has your research data been retained in a secure and accessible form and will it remain so for the required duration?  

- [ ] YES  
- [ ] NO

e) Does your research comply with all legal, ethical, and contractual requirements?  

- [ ] YES  
- [ ] NO

Candidate Statement:

I have considered the ethical dimensions of the above named research project, and have successfully obtained the necessary ethical approval(s)

Ethical review number(s) from Faculty Ethics Committee (or from NRES/SCREC):  

0EB4-A23B-CB3A-4B87-EC11-64E1-8B48-9D1D.

If you have not submitted your work for ethical review, and/or you have answered ‘No’ to one or more of questions a) to e), please explain below why this is so:

UPR16 – August 2015

218