JoinSTNassistant Framework: An Agile Holistic Framework for Assisting Decision in Healthcare Facilities to Join Saudi Telemedicine Network

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Abstract

In 2011, the Saudi Arabian Ministry of Health (MOH) launched the Saudi Telemedicine Network (STN) as the first national project for telemedicine in the KSA, which is planned to be completed by 2020. The benefits associated with the STN will only be realised through its successful implementation within the Healthcare Facilities (HCFs) across the Kingdom of Saudi Arabia (KSA). There is a high failure rate of implementation projects of telemedicine within other countries (approximately 75% globally, and 90% in developing countries). Furthermore, there is high failure rate of implementation projects of complex Health Information Technology (HIT) systems within HCFs of the KSA (roughly 80%). These dramatic statistics demonstrate the great need for a suitable framework to assist the STN implementation and increase the likelihood of its successful implementation. Prior studies have asserted that there could not be a one-size-fits-all framework that could be applicable and used by all countries for assisting the implementation of telemedicine. To the best of our knowledge, there is not any existing framework that has been specifically developed for assisting the STN implementation.

Thus, this research is aimed at developing a novel, agile, holistic framework, referred to as "JoinSTNassistant Framework", aimed to assist HCFs across the KSA regarding their organisational decision to join the STN. It must be ensured that this JoinSTNassistant Framework is theoretically rigorous, as well as relevant specifically to the context and the needs of the KSA, its HCFs, and the STN roadmap. Therefore, the JoinSTNassistant Framework has been developed through three-sequential phases. The First Phase of development defines and applies the theoretical and philosophical foundations of the JoinSTNassistant Framework. In this First Phase, 56-selected studies from an extensive literature review were analysed. The Second and Third phases of development reflect the practical and pragmatic requirements of the JoinSTNassistant Framework. These two phases must be considered as two stages of validation of the findings of the First Phase, involving as many potential users as possible in the development of the Framework, so as to ensure that it reflects their expectations and meets their needs. The Second Phase of development involved interviews with 81 strategic-level decision makers of HCFs within the KSA. The Third Phase implemented an even higher level of validation, involving as many as 905 potential users, forming a representative sample size of the decision makers of all HCFs across the KSA. In addition, a web-based application (i.e., Portal) for the JoinSTNassistant Framework, referred to as "JoinSTNassistant Portal" was developed for modifying and adjusting the JoinSTNassistant Framework in order to be applicable for each one of HCFs across the KSA, for assisting and guiding them in reaching a decision to join the STN.

This research is part of the STN project and is collaborating with the National eHealth Strategy and Change Management Office in the MOH of KSA, and with the STN agency, who is the sponsor and the owner of the STN project.

Keywords: Telemedicine; Saudi Telemedicine Network; Barriers; Holistic Framework.

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Last but not least, all thanks and sincere gratitude to my mother, my wife, my two sons, my daughter, and my brothers and sisters for their emotional support and prayers and for tolerating my absence from many important occasions during my PhD journey.

Dedication

This thesis is dedicated to …

The soul of my father, may God have mercy on him…

My mother Feryal…

My wife Maryam…

My two sons Abdullah and Adel…

My daughter Feryal…

My Brothers and Sisters…

Cancer fighters and survivors.

Publications

- Alaboudi, A., Atkins, A., and Sharp, B. (2015). 'A Holistic Framework for Assisting Decision Makers of Healthcare Facilities to Assess Telemedicine Applications in Saudi Arabia.' *In: eTELEMED 2015: The Seventh International Conference on eHealth, Telemedicine, and Social Medicine, Lisbon: IARIA*, pp. 203–208

- Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M. & Sunbul, T. (2016). 'Barriers and challenges in adopting Saudi Telemedicine Network.' *In: ISHIC: The 1st International Saudi Health Informatics Conference. 2016, Riyadh, Saudi Arabia*, pp. 50-51.

- Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M. & Sunbul, T. (2016). 'Barriers and Challenges in Adopting Saudi Telemedicine Network: The Perceptions of Decision Makers of Healthcare Facilities in Saudi Arabia', *Journal of Infection and Public Health*, 9 (6). p.pp. 725–733

- Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M. & Sunbul, T. (2017). 'Perceptions and Attitudes of Clinical Staff Towards Telemedicine Acceptance in Saudi Arabia.' *In: AICCSA 2016: the 13th ACS/IEEE International Conference on Computer Systems and Applications, Agadir, Morocco*, (in press).

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Abbreviations List

Abbreviation	Full form
CBA	Cost-Benefit Analysis
CDSI	Central Department of Statistics and Information in the Saudi Arabia
CoP	Communities of Practice
EHR	Electronic Health Record
HCFs	Healthcare Facilities
HIS	Hospital Information Systems
HIT	Health Information Technology
ICT	Information and Communication Technology
ICU	Intensive Care Unit
ILO	International Labour Organisation
Infoway	Canada Health Infoway
KFSHRC	King Faisal Specialist Hospital and Research Centre in Saudi Arabia
KSA	Kingdom of Saudi Arabia
LIS	Laboratory Information System
MENA	Middle East and North Africa region
MOD	Saudi Arabian Ministry of Defence
MOH	Saudi Arabian Ministry of Health
OTN	Ontario Telemedicine Network
PHCs	Primary Healthcare Centres
PIS	Pharmacy Information System
PP	Payback Period
RIS	Radiology Information System
ROI	Return On Investment
STN	Saudi Telemedicine Network
TOE	Technology–Organisation–Environment theoretical framework
WHO	World Health Organisation

Chapter 1: Introduction

1.1 Background and Motivation

The KSA healthcare system is experiencing difficulties, and the MOH is under tremendous pressure from the KSA government, regarding improving access to healthcare services and providing high-quality healthcare services to all residents, especially in remote and rural areas (Khudair, 2008; El-Mahalli et al., 2012; MOH, 2013). The KSA residents experience long waiting lists for many healthcare services (Canada Health Infoway, 2013; Alamri et al., 2006). In addition, there is a dearth of healthcare services for disadvantaged groups (e.g., the elderly) and people with special needs (e.g., disability), particularly in rural and remote areas, which are not receiving appropriate attention (Canada Health Infoway, 2013).

In 2010, the MOH expressed strong support for telemedicine, based on a study with Canada Health Infoway (Infoway) and Ontario Telemedicine Network (OTN) into the adoption of telemedicine within the KSA's healthcare system. This study had shown how telemedicine promises can alleviate many difficult challenges that prevent the improvement of the KSA healthcare system (Canada Health Infoway, 2013). In 2011, the Saudi Telemedicine Network (STN) was launched as the first national project for telemedicine in the KSA, and it is planned to be completed by 2020 (Canada Health Infoway, 2013).

The benefits associated with the STN will only be realised through its successful implementation and optimisation within the KSA healthcare system (i.e., within the HCFs across the KSA). Worldwide, 75% of such projects are abandoned or 'failed outright', and this percentage has reached 90% in developing countries (Van Dyk et al., 2012; Nauta et al., 2015; Kaplan & Harris-Salamone, 2009; Zailani et al., 2014; Healy, 2008). Furthermore, roughly 80% of the implementation projects of such complex Health Information Technology (HIT) systems within the KSA healthcare system are failed projects, in spite of the KSA government commitments, funding, and support (Abouzahra, 2011). For instance, since 2005, the MOH still struggles with the implementation process of Electrical Health Record (EHR) system within the KSA's healthcare system, to achieve its primary aim and its expected benefits (Khalifa, 2013; Khudair, 2008; MOH, 2016). Even now, there is a large gap between the planning for the introduction of the EHR system and its successful implementation (Khalifa, 2013; Khudair, 2008; MOH, 2016).

In 2012, the National Department of Health (NDoH) in South Africa, although it recognised the potential of telemedicine, acknowledged the initial failure in implementing a telemedicine system (Van Dyk, 2013). Similarly, in Malaysia, the telemedicine system was initiated in 1997, but to date, most telemedicine projects failed to take off (Zailani et al., 2014). In 2011, the United Kingdom (UK) government officially declared the failure of one of its eHealth project, the 'National Health Service National Programme for ICT', launched in 2002 and costing the UK government more than £12bn (Martin, 2011). Also, in Australia, in 2011, its ministry of health has announced its failure in one of its eHealth initiative, the 'Personally Controlled Electronic Health Records', which cost AU$1bn (≈£600m) (Taylor, 2013).

These dramatic statistics, and the historical issue of losing time and cost, resulting from the failure of implementing such complex ICT systems within the KSA's healthcare system, led the MOH to recognise the need to involve researchers in the STN implementation project in order to contribute in increasing the likelihood of successful implementation of the STN.

Hence, in April 2014, my supervisor Prof. Atkins and I were invited by Dr. Alyemeni, Deputy Minister of Health in KSA and Dr. Balkhair, Director of the National eHealth Strategy and Change Management Office in MOH and the STN agency, to be involved in the STN implementation project and to attend a conference on the roadmap of the STN implementation in Riyadh, the KSA. During which time, we had several private meetings with Dr. Alyemeni, Dr. Balkhair, and some members of the MOH and the STN agency to discuss collaboration on this research and to identify challenges that could be addressed and resolved by this research. Our research has been agreed to be a part of the STN project and is based on the STN roadmap.

Consequently, the motivation of this research is to contribute to the facilitation of the STN implementation process and to increase the likelihood of its successful implementation. This research is a part of the STN project and is collaborating with the National eHealth Strategy and Change Management Office in the MOH and the STN agency who is the sponsor and the owner of the STN project.

1.2 Research Scope

A variety of stakeholders' groups (e.g., HCFs across KSA, academic entities, commercial enterprises, etc.) are essential for the successful implementation of the STN. However, the strategic-level decision makers of HCFs across the KSA are the most important stakeholders' group of the STN, and are the backbone and the

cornerstone of the successful implementation of the STN. This is because the key function/goal of the STN is to provide telemedicine services to all HCFs sites across the KSA, whereby they could collaborate with one another and provide healthcare services, in particular, for those people from deprived areas which suffer severely from the lack of healthcare services (Canada Health Infoway, 2013). Therefore, the STN will not achieve its key function/goal and will not be implemented successfully unless all HCFs sites across the KSA join the STN.

For this reason, as shown in Figure 1.1, the STN roadmap sets a 5-year performance targets in order to provide a measure of achievement and to track the success of the STN implementation over time (Canada Health Infoway, 2013). Based on the 5-year performance targets, for the STN to be implemented and to achieve its goal, around 560 HCF sites across the KSA should join the STN by the end of the fifth year of operation (Canada Health Infoway, 2013).

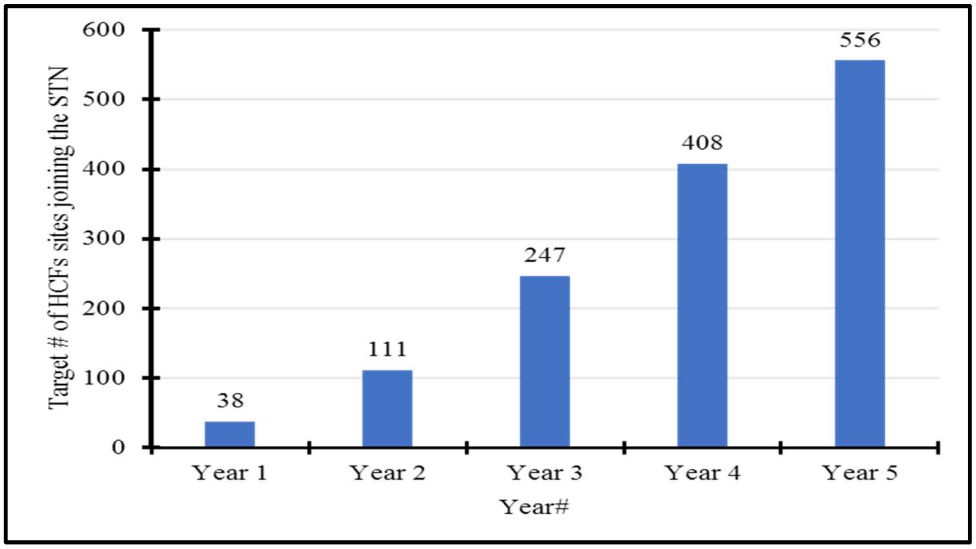

Figure 1.1 The 5-Year Performance Targets for the STN (Canada Health Infoway, 2013)

Thus, the scope of this research has been identified as to be restricted to find or develop an applicable framework for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN.

1.3 Research Gap, Aim, Question, and Objectives

As will be discussed and highlighted later in Chapter 2 (Section 2.6), the literature review reveals that there is a limited number of existing organisational decision-making frameworks/models for assisting the implementation of telemedicine system in HCFs within any countries/organisations. Furthermore, these existing frameworks/models are generic and limited in their applicability. Therefore, we argue

that they are neither suitable nor effective for assisting and guiding the strategic-level decision makers of HCFs across KSA regarding their organisational decision to join the STN. In addition, we argue that, to the best of our knowledge, there is not any existing organisational decision-making framework/model that has been specifically developed for this purpose.

Thus, this research is not intended to develop a rival to existing frameworks, but its main aim is to develop a novel, agile, holistic framework, referred to as "JoinSTNassistant Framework", to bridge this gap.

Knight and Cross (2012) as well as Clough and Nutbrown (2012) have argued that the research question(s) helps in framing the research, thereby assisting the researcher to determine the best methodology to conduct the research, in order to provide scientific explanations/answers to the research question(s). Thus, the main research question for this study can be expressed as follow:

> *How to develop the JoinSTNassistant Framework that can assist and guide the strategic-level decision makers of HCFs across KSA regarding their organisational decision to join the STN?*

It must be ensured that this framework is theoretically rigorous, as well as relevant specifically to the context and the needs of the KSA, its HCFs, and the STN roadmap. Therefore, the following objectives were identified to achieve the research aim and answer its question:

I. To conduct a review of an extensive literature on:
   i. Telemedicine, its classification, and potential benefits.
   ii. The healthcare system of the KSA, and its current challenges that could be alleviated by implementing the STN successfully.
   iii. The implementation of telemedicine in the KSA healthcare system.
   iv. The STN roadmap and its important findings and recommendations.
   v. Existing frameworks/models (related work/ state of the art).

II. To develop the JoinSTNassistant Framework by identifying the following:
   i. A suitable theory(s) underpinning this research and to be used as the theoretical foundation and as the structured guide for the development of the JoinSTNassistant Framework.
   ii. Its fundamental pillars, through identifying the important predictive pillars within the scope of this research, and acting as influential pillars of the HCFs across the KSA regarding their organisational decision to join the STN.

iii. The variables of its fundamental pillars, through identifying the relevant important predictive organisational-level barriers that are expected to act as influential barriers, with respect to the decision of HCFs across the KSA to join the STN, fully within the scope of this research. Those barriers should be appropriate to the context and the needs of the KSA, its HCFs, and the STN roadmap.
iv. A suitable decision-assist technique(s) to be utilised by the JoinSTNassistant Framework.
v. Key features that should be incorporated/considered into the JoinSTNassistant Framework.
vi. A measurable and tangible parameter/metric for each variable of the JoinSTNassistant Framework.

III. To develop a web-based application (i.e., Portal) for the JoinSTNassistant Framework, to be a tool for enabling it to be used by HCFs for assisting and guiding their organisational decision to join the STN.
IV. To evaluate and validate the JoinSTNassistant Framework by conducting a study with its potential users.
V. To refine and modify the JoinSTNassistant Framework, based on findings of evaluation and validation study.

1.4 Research Contributions to Knowledge

The core novel contribution of this PhD research is the development of the JoinSTNassistant Framework for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN. The JoinSTNassistant Framework is a novel, holistic, and agile framework because of the following:

i. It is a novel framework in terms of its scope and its new context, since it is developed to be appropriate to the context and the needs of the KSA, its HCFs, and the STN roadmap. As discussed and highlighted in Chapter 2 (Section 2.6), the existing frameworks/models are neither suitable nor effective for assisting and guiding the strategic-level decision makers of HCFs across KSA regarding their decision to join the STN. In addition, we argue that, to the best of our knowledge, there is not any existing framework that has been specifically developed for this purpose.
ii. It is a holistic framework in terms of the following three points:
    - Firstly, its applicability for **all** the HCFs within the KSA, for assisting their decision to join the STN, as discussed and highlighted in Chapter 4 (Section 4.4).

- Secondly, covering the important predictive pillars within the scope of this research, and those acting as influential pillars of the HCFs across the KSA regarding their organisational decision to join the STN.
- Thirdly, containing the relevant important predictive organisational-level barriers that are appropriate to the context and the needs of the KSA, its HCFs, and the STN roadmap. Such barriers are also expected to act as influential barriers, with respect to the decision of HCFs across the KSA to join the STN, fully within the scope of this research.

iii. It is considered as an agile framework, as it was developed to be adjustable and allows modification to changing environment and the framework also allows the 'cards' to be added or deleted as applicable for all HCFs within the KSA.

Other novel contributions of this PhD research are listed below:

i. Identifying the important predictive pillars and their relevant important predictive organisational-level barriers that are expected to act as influential barriers, with respect to the decision of HCFs across the KSA to join the STN, and fully within the scope of this research. Those pillars and their relevant should be appropriate to the context and the needs of the KSA, its HCFs, and the STN roadmap. As discussed and highlighted in Chapter 3 (Section 3.3 and 3.4), we argue that, to the best of our knowledge, no comprehensive scientific study has investigated these pillars and their relevant barriers in HCFs across the KSA and at a national level.

ii. Identifying the perspectives of the strategic-level decision makers of HCFs across the KSA regarding the following points:
    - The decision-making process and its expected challenges of the HCFs to join the STN, as discussed and highlighted in Chapter 6 (Section 6.2).
    - The most suitable decision-assist technique for assisting and guiding the HCFs' organisational decision to join the STN, as discussed and highlighted in Chapter 6 (Section 6.2).
    - The most suitable parameter/metric for each barrier of the JoinSTNassistant Framework, to become measurable and tangible barriers, for assisting each HCF to manage its progress of resolving its barriers and joining the STN successfully, as discussed and highlighted in Chapter 6 (Section 6.2).

- The types of information required and needed by the strategic-level decision makers for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN, as discussed and highlighted in Chapter 6 (Section 6.2).

iii. Developing a web-based application (i.e., Portal) for the JoinSTNassistant Framework, referred to as "JoinSTNassistant Portal". As discussed and highlighted in Chapter 6, this Portal was developed for modifying and adjusting the JoinSTNassistant Framework in order to be applicable for each one of HCFs across the KSA, for assisting and guiding them in reaching a decision to join the STN.

1.5 Research Philosophy

Knight and Cross (2012) have explained that, in the research context, research philosophy describes the philosophical beliefs and assumptions chosen and adopted by the researchers to understand and analyse the data obtained, and then develop/create new findings/knowledge (i.e., build their research). There are four main philosophical paradigms, namely Positivism, Realism, Pragmatism, and Interpretivism (Knight & Cross, 2012; Scott & Briggs, 2009; Johnson & Onwuegbuzie, 2004; Morgan, 2007).

Scott and Briggs (2009) as well as Johnson and Onwuegbuzie (2004) have argued that the Pragmatism paradigm provides the best appropriated base to be adopted in research related to the implementation of ICT systems within the healthcare field. This is because the healthcare field, particularly its clinical practice, is a pragmatic field and the stakeholders in this field are pragmatists and will only accept research that adopted the Pragmatism philosophy (Scott & Briggs, 2009; Johnson & Onwuegbuzie, 2004).

Thus, this research adopts the Pragmatism philosophy, which in its essence is that any proposition, innovation, idea, or ideology can be considered "**true"** if and only if there is empirical, reliable, and credible evidence (e.g., if it works satisfactorily) (Knight & Cross, 2012; Scott & Briggs, 2009; Johnson & Onwuegbuzie, 2004; Morgan, 2007). Accordingly, this PhD research will only be based on existing empirical, reliable, and credible evidence (data). Furthermore, the methodologies used by this PhD research will be chosen and adopted to be compatible with the Pragmatism philosophy, which will result in valuable findings for this PhD research. These findings form/compose the JoinSTNassistant Framework.

1.6 Research Approach and Data Collection Method

Research approaches could be classified into three basic categories: quantitative, qualitative, and mixed-methods (qualitative and quantitative) approaches (Peffers et al., 2007; Creswell, 2013).

Firstly, the qualitative approach, which normally is an inductive approach and aimed at gaining in-depth understanding or explanation regarding a given topic or phenomenon (Polonsky & Waller, 2014; Peffers et al., 2007; Creswell, 2013). There are several data collection methods for qualitative research. Some common methods include literature review, interview discussions, and observations (Peffers et al., 2007; Creswell, 2013).

Secondly, the quantitative approach, which normally is a deductive approach and aimed at gathering data in numerical and statistical form, which can be put into categories, or in rank order, or measured in units of measurement (Polonsky & Waller, 2014; Peffers et al., 2007; Creswell, 2013). A questionnaire with closed-ended questions is the most common data collection methods for quantitative research, whereby responses are gathered and then analysed quantitatively and deductively, in order to prove or answer the research question or hypothesis statistically (Peffers et al., 2007; Creswell, 2013).

Thirdly and finally, the mixed-methods (qualitative and quantitative) approach, which is a process of using both quantitative and qualitative methods together for collecting and analysing data (Peffers et al., 2007; Creswell, 2013). Creswell (2013) has argued that every research method (qualitative and quantitative) has its limitations and each method could be considered complementary to the other. Furthermore, both deductive and inductive strategies are present in the mixed-methods approach (Polonsky & Waller, 2014; Peffers et al., 2007; Creswell, 2013). Thus, the mixed-methods approach strengthens the research findings from different (qualitative and quantitative) aspects, which help explain unexpected and/or conflicted findings, resulting in more reliability and validity of the research findings (Polonsky & Waller, 2014; Peffers et al., 2007; Creswell, 2013). One technique of adopting the mixed-methods approach is the triangulation technique (Polonsky & Waller, 2014; Creswell, 2013). This technique is explained as the use of two or more diverse data collection methods of both qualitative and quantitative approach (e.g., interviews, questionnaires, literature review, etc.) to collect qualitative and quantitative data sets regarding the same phenomenon or topic. Afterward, these collected data sets are compared among themselves, to either cross-

validate data or to capture diverse aspects of the same phenomenon or topic (Polonsky & Waller, 2014; Creswell, 2013; Johnson & Onwuegbuzie, 2004).

Morgan (2007) as well as Scott and Briggs (2009) have argued that research that adopted the Pragmatism philosophy should also adopt the triangulation technique of the mixed-methods approach. This is because this technique provides more credibility and reliability to a given research and its findings, which could convince the pragmatists (Morgan, 2007; Scott & Briggs, 2009).

Thus, as shown in Figure 1.2, this PhD research applied the triangulation technique of the mixed-methods approach. Consequently, the final findings of this PhD research (the JoinSTNassistant Framework) has been developed through three-sequential phases, described below.

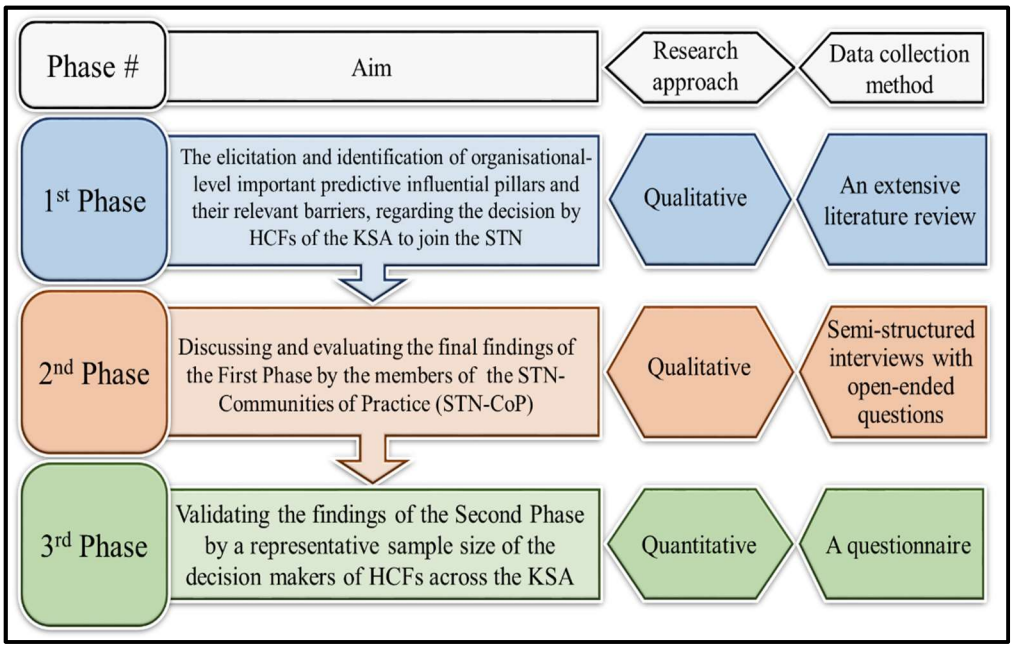

Figure 1.2 The Three-Sequential Phases of the Development of JoinSTNassistant Framework, their Research Approach, and Data Collection Method.

1.6.1 First Phase of Development of the JoinSTNassistant Framework

The aim of this First Phase is the elicitation and identification from the literature review of organisational-level important predictive influential pillars and their relevant barriers, regarding the decision by HCFs of the KSA to join the STN. This First Phase is discussed and presented in detail in Chapter 3.

The qualitative data analysis approach has been applied in this First Phase for analysing the data obtained from an extensive literature review. The final outcome of this First Phase is The Initial Version of the JoinSTNassistant Framework, as shown in Chapter 3 (Figure 3.6).

1.6.2 Second Phase of Development of the JoinSTNassistant Framework

This Second Phase reflects the practical and pragmatic requirements of the JoinSTNassistant Framework. This is done by means of conducting interviews with open-ended questions, with strategic-level members of the STN-Communities of Practice (STN-CoP). One of the main aims of this Second Phase is to discuss and evaluate the final outcome of the First Phase (the Initial Version of the JoinSTNassistant Framework) with strategic-level members of the STN-CoP. This Second Phase is discussed and presented in detail in Chapter 4.

The cross-case qualitative comparative analysis technique has been applied in this Second Phase for analysing the data obtained from the interviews. The final outcome of this Second Phase is the developed (i.e., revised) version of the JoinSTNassistant Framework, referred to as the Developed Version of the JoinSTNassistant Framework, as shown in Chapter 4 (Figure 4.3).

1.6.3 Third Phase of Development of the JoinSTNassistant Framework

This Third Phase consists of a questionnaire based survey, conducted in the KSA. This questionnaire was based on the findings of the Second Phase (i.e., the Developed Version of the JoinSTNassistant Framework) and aimed at validating them by a representative sample size of the decision makers of HCFs across the KSA. This Third Phase is discussed and presented in detail in Chapter 5.

The quantitative method was used in the data analysis of this questionnaire. Accordingly, the Developed Version of JoinSTNassistant Framework has been further revised and updated to incorporate the findings of this Third Phase, and it is referred to as the "Final Version of the JoinSTNassistant Framework", as shown in Chapter 5 (Figure 5.3).

1.7 The Ethical Statement

This PhD research project and all its all phases were reviewed and approved by the Faculty Research Ethics Committee at Staffordshire University and by the Regional Research Ethics Committee at MOH (as shown in Appendices A and B), and they are conducted in full compliance with their code of practice. For instance, all respondents in this research were informed about the purpose of this research and they gave their consent for participation. Respondents were:

i. Asked not to participate in this research if they are vulnerable to coercion or undue influence;

ii. Assured that all answers will be treated in confidence and that their names are not required;
iii. Assured that they could withdraw from this research at any time without any consequences;
iv. Informed that their participation in this research is voluntary and that there are no direct personal benefits for participating in this research;
v. Assured that there are no risks associated with participation.

1.8 Thesis Structure

As shown in Figure 1.3, the rest of this thesis is structured as follows:

- **Chapter 2** provides a review of the relevant telemedicine and healthcare aspects in the Kingdom of Saudi Arabia (KSA), upon which this research is based. Furthermore, in this chapter, previous related works on existing organisational decision-making frameworks/models were reviewed and discussed.
- **Chapter 3** introduces and discusses the First Phase of the Development of the JoinSTNassistant Framework. This chapter presents the findings of an extensive literature review. In addition, this chapter highlights and discusses the theoretical foundations underpinnings this PhD research, which is the Technology–Organisation–Environment (TOE) theoretical framework).
- **Chapter 4** introduces and discusses the Second Phase of the Development of the JoinSTNassistant Framework. This chapter presents the findings of interviews with strategic-level members of the STN-Communities of Practice (STN-CoP).
- **Chapter 5** describes the Third Phase of the Development of the JoinSTNassistant Framework, and presents the findings of the questionnaire, conducted in the KSA.
- **Chapter 6** describes and discusses the development of a web-based application (i.e., Portal) for the JoinSTNassistant Framework, referred to as "JoinSTNassistant Portal". In this chapter, the decision-assist technique utilised by the JoinSTNassistant Framework was discussed and highlighted.
- **Chapter 7** highlights and discusses the validation and evaluation conducted to validate and evaluate the JoinSTNassistant Framework and Portal
- **Chapter 8** concludes the PhD research and presents suggestions for future work.

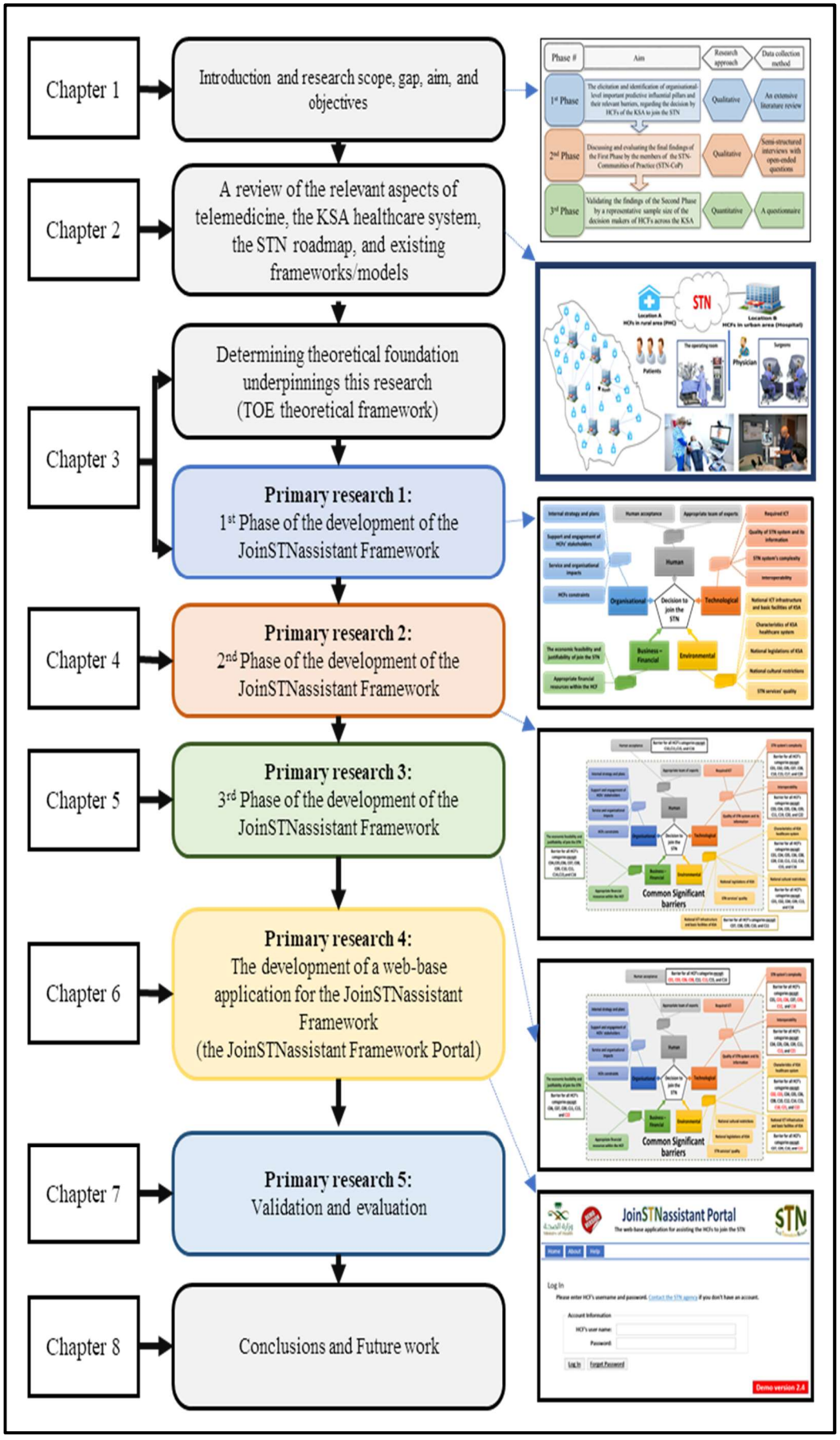

Figure 1.3 Thesis Structure

Chapter 2: Review of Telemedicine, Healthcare and Associated Models, Particularly in Saudi Arabia

2.1 Introduction

This chapter provides a review of the relevant telemedicine and healthcare aspects in the Kingdom of Saudi Arabia (KSA), upon which this research is based. This chapter will help gain an understanding of telemedicine, as well as provide an introduction to the thesis.

Section 2.2 introduces relevant definitions and concepts related to telemedicine; then its potential benefits and a classification of telemedicine applications are presented. A brief review of the KSA healthcare system is presented in Section 2.3.

Section 2.4 discusses the challenges to the KSA healthcare system that could be alleviated by implementing telemedicine. Section 2.5 introduces the historical facts relating to the implementation of telemedicine in the KSA healthcare system; and the Saudi Telemedicine Network (STN) roadmap and some of its recommendations are highlighted.

Section 2.6 reviews previous related works on existing organisational decision-making frameworks/models; and the conclusions to this chapter are presented in Section 2.7.

2.2 Telemedicine, its Classification, and Potential Benefits

Telemedicine, - whose name is derived from the Greek, meaning "medicine at a distance" - is broadly defined as the use of Information and Communications Technology (ICT) to diagnose and treat disease and ill-health, overcoming geographical barriers by the interactive transmission of clinical data, signals and biomedical images of patients, so as to achieve the best possible healthcare services (Darkins & Cary, 2000; Ekeland et al., 2010; WHO, 2010). In other words, telemedicine is the utilisation of ICT to provide clinical services when distance separates the participants (Masys, 1997).

The concept of telemedicine has been implemented and used since 1910, started by Einthoven to transfer Electrocardiograms (ECGs) and Electroencephalogram (EEGs), to support and diagnose medical conditions from one location to another (Stanberry, 2000). However, the rapid growth of ICT innovation, as well as the rapid decline in its cost in the 1990s, have enabled HCFs to visualise activities and consider the implementation of telemedicine in their sites (Wootton et al., 2013). Telemedicine is

now the major component of eHealth and has experienced tremendous growth over the past 25 years (Healy, 2008). The global telemedicine market grew from $9.8 billion in 2010 to $11.6 billion in 2011, and will reach $27.3 billion by 2016 (Cresswell & Sheikh, 2015; Patel, 2014). BBC research indicated that by 2018, 65% of the interactions between healthcare organisations and patients will be done remotely via telemedicine applications (Patel, 2014).

The World Health Organization (WHO) (2010) and others researchers such as Van Dyk (2014), Bashshur et al. (2011), and Ekeland et al. (2010) stated that there is confusion between the terms of telemedicine, telehealth, and telecare, since sometimes these terms are used synonymously, although there are scientifically and technically significant differences between them. Telemedicine is a sub-field of telehealth and telehealth relates to telemedicine the same way that health relates to medicine. Telecare refers to the idea of using ICT to provide remotely needed support, care, and reassurance for people (e.g., elderly and physically less able people), in order to enable them to live independently in their place of domicile (Stowe & Harding, 2010). However, telemedicine, telehealth, and telecare, as shown in Figure 2.1, go under the umbrella of eHealth, which is defined by the WHO as the transfer of health resources and healthcare by electronic means, or as the use of ICT for health. This includes treating patients, conducting research, educating the health workforce, tracking diseases, and monitoring public health (WHO, 2017).

For this research, to differentiate between telemedicine, telehealth and telecare, the following definitions will be used:

- Telemedicine: "The utilisation of ICT by clinical staff (e.g., physicians, nurses, etc.), who need additional input from other remote clinical staff to improve the clinical service that they deliver."
- Telehealth: "The utilisation of ICT to transfer healthcare information to provide healthcare, administrative and educational services remotely."
- Telecare: "The utilisation of ICT to transfer medical information to provide remotely the needed support, care, and reassurance to people in their place of domicile."

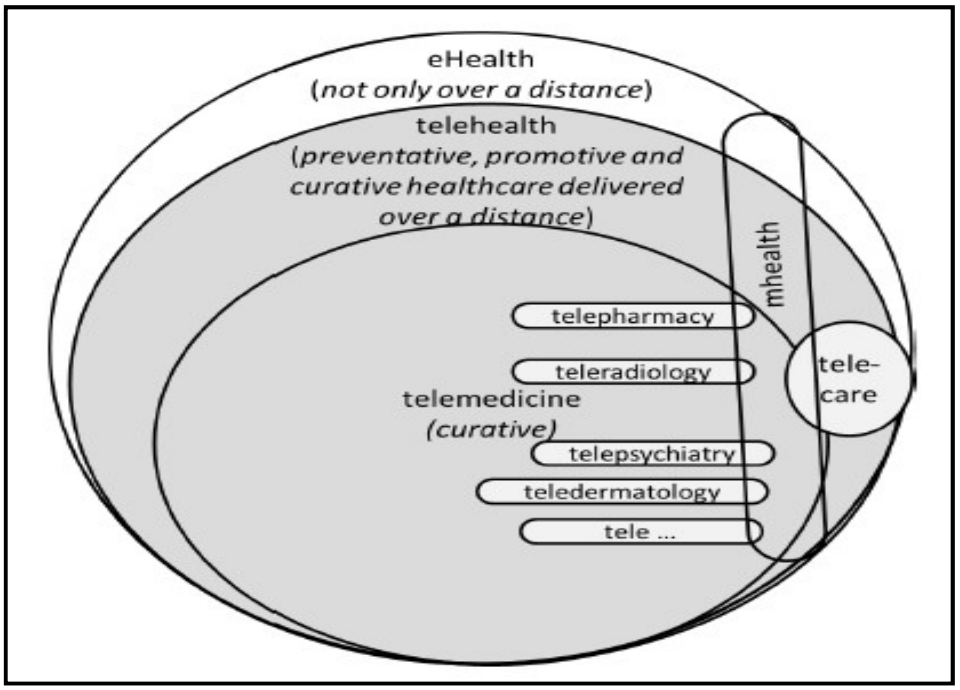

Figure 2.1Telemedicine, eHealth, Telehealth, and Telecare (Van Dyk, 2014)

These definitions are compatible with the definitions that are used and approved by the Saudi Arabian Ministry of Health (MOH) and different studies and organisations (e.g., Norris (2002), Stowe and Harding (2010), Darkins and Cary (2000), the WHO (2010)).

2.2.1 Potential benefits of telemedicine

The literature review contains a multitude of potential benefits of telemedicine, addressing diverse challenges in healthcare systems. It would not be useful or relevant to mention all these benefits, since the main point to make is that, as the WHO reported and researchers clarified, telemedicine will become the mainstream of the healthcare services globally (WHO, 2010; Ebad, 2013). Telemedicine will revolutionise and improve the whole healthcare systems and services globally in the near future (WHO, 2010; Ebad, 2013). However, some of the potential benefits of telemedicine can

i. Improve healthcare quality, delivery, efficiency, effectiveness and accessibility;
ii. Reduce healthcare services cost; and
iii. Help resolve the shortages of clinical staff, and in resolving the concentration of clinical staff in capital cities (WHO, 2010; Ebad, 2013; Patel, 2014; Mars, 2013).

2.2.2 Classification of telemedicine applications

Telemedicine has been applied to a wide area of healthcare services, particularly image-dependent healthcare services (e.g., radiology, pathology, cardiology, dermatology, etc.), and each of these has its own telemedicine application. Telemedicine applications are classified into two basic types: real-time (synchronous) applications and store-and-forward (asynchronous) applications (Ebad, 2013; WHO, 2010). This classification relates to the timing of the information transmitted and to the interactions between the involved clinical staff (Ebad, 2013; WHO, 2010).

Real-time (synchronous) applications (e.g., tele-consultation, tele-surgery, tele-stroke, etc.) are for online interaction (live interactive) between the involved clinical staff within different locations. So, all participants shall be available online in the session at the same time (Ebad, 2013; WHO, 2010), whereas, store-and-forward (asynchronous) applications (e.g., tele-radiology, tele-pathology, etc.) are for transmitting medical information (e.g., x-ray, images, etc.) to another clinical staff within different location. This type of applications is used for non-emergency healthcare services where diagnosis is made after medical information arrive (Ebad, 2013). It requires basic ICT infrastructure and generally it is not disruptive to traditional workflows of clinical staff, as there is no live interaction between the sender and receiver (Ebad, 2013). Therefore, it is relatively simple to implement and less expensive than real-time (synchronous) applications (Ebad, 2013; WHO, 2010).

2.3 The Healthcare System of the Kingdom of Saudi Arabia (KSA)

The KSA government is obliged to provide free healthcare services to all Saudi citizens and to expatriates who are working within the public sectors, while expatriates who are working within private sectors usually have a health insurance paid by their company (MOH, 2016; Aldossary et al., 2008). The Saudi Arabian Ministry of Health (MOH), under the management of the Minister of Health, has a broad set of responsibilities, which include: managing and regulating the KSA healthcare system, funding and overseeing its Healthcare Facilities (HCFs), as well as monitoring all other HCFs across the KSA that belong to other sectors (e.g., private, military, etc.) (MOH, 2016). The majority of HCFs within KSA are autonomous (self-operating) and are either branches of or have collaborated (are twinned) with different international healthcare providers (Canada Health Infoway, 2013; MOH, 2016; Albejaidi, 2010). By 2020, the KSA government will privatise all HCFs across the KSA and all of them

will be autonomous (self-operating) and either are branches of or have collaborated with different international healthcare providers (Saudi Vision 2030, 2016).

The KSA healthcare system has a complex structure and its current state is such that there is a diverse set of Healthcare Facilities (HCFs) participating in the KSA healthcare system, which deliver healthcare services - both government and non-government-based (MOH, 2016). This diversity is based, firstly, on the size and nature of the healthcare services that are provided. The HCFs are of five types: Primary Healthcare Centres (PHCs), Specialised Clinics, Polyclinic Centres, Hospitals, and Medical City (i.e., Medical Towers) (MOH, 2016; Aldossary et al., 2008). Then, secondly, they belong to four different sectors: MOH sector, other governmental sectors, military sector, and private sector (MOH, 2016). The HCFs under the MOH sector are the core provider of healthcare services in the KSA and comprise 48.2% of the total HCFs in the KSA and 59.3% of the total beds, as shown in Table 2.1 (MOH, 2016). Finally, they are located in both urban and rural/ remote areas.

Table 2.1: HCFs and Beds in the KSA, based on their Sectors.

		MOH sector	Other Gov. sector	Military sector	Private sector	Total
Total HCFs	#	2,901	265	169	2,678	6,013
	%	48.2%	4.4%	2.8%	44.5%	100%
Total beds	#	40,300	7,400	4,632	15,664	67,996
	%	59.3%	10.9%	6.8%	23.0%	100%

The healthcare services in the KSA healthcare system are delivered at three levels. The first level is the primary level, which includes vaccinations, common procedures, and mother-and-child services, and is provided by PHCs and Specialised Clinics (MOH, 2013). The secondary level, to which are referred cases that require more advanced healthcare services, includes specialists or consultants who are available within hospitals or Polyclinic Centres (MOH, 2013). Health cases that need more complex levels of healthcare are transferred to one of the Medical Cities (the tertiary and third level of healthcare) (MOH, 2013). In some exceptional cases, where the cases are very complex and rare, the patient is referred outside the KSA for treatment (Aldossary et al., 2008).

2.4 The Challenges of the KSA Healthcare System that could be Alleviated by Implementing Telemedicine

The KSA healthcare system is experiencing difficulties, and the MOH is under tremendous pressure from the KSA government, regarding improving access to healthcare services and providing high-quality healthcare services to all residents, especially in remote and rural areas (Khudair, 2008; El-Mahalli et al., 2012; MOH, 2013). The KSA residents experience long waiting lists for many healthcare services (Canada Health Infoway, 2013; Alamri et al., 2006). In addition, there is a dearth of healthcare services for disadvantaged groups (e.g., the elderly) and people with special needs (e.g., disability), particularly in rural and remote areas, which are not receiving appropriate attention (Canada Health Infoway, 2013).

The MOH faces many sets of difficult challenges that prevent the improvement of the KSA healthcare system, some of which, - particularly those that can be alleviated by telemedicine concepts - are outlined in the following subsections:

2.4.1 The shortage of clinical staff

The successful provision of healthcare services in a given country requires a compatible number of clinical staff in all parts of the country. Shortage destabilises healthcare systems and threatens the health of individuals and populations (OECD, 2013; Jensen, 2013). The WHO (2006) clarified that if any country, or a certain part of it, has fewer than 22.8 clinical staff per 10,000 population, such a country is failing to achieve adequate coverage rates for essential healthcare interventions. This, as shown in Table 2.2, is the case of the KSA healthcare system, which suffers severely from a lack of clinical staff in all its health regions, except Jeddah and marginally in Riyadh (Alamri et al., 2006; MOH, 2016).

Table 2.2: Clinical Staff per 10,000 Population for Each Health Regions within KSA.

Health Regions	Clinical Staff per 10,000 Population	Health Regions	Clinical Staff per 10,000 Population
Riyadh	22.3	Bishah	14.9
Makkah	16.8	Tabuk	14.6
Jeddah	29.6	Ha'il	11.8
Ta'if	14.4	Northern	9.2
Medinah	14.1	Jazan	14.9
Qaseem	11.6	Najran	10.1
Eastern	19.0	Al-Bahah	10.9
AL-Ahsa	16.9	Aljouf	6.6
Hafr Al_baten	10.6	Qurayyat	10.7
Aseer	17.0	Qunfudah	14.9

In the KSA healthcare system, as shown in Table 2.3, the numbers of consultant physicians are mostly fewer than the number of hospitals, and, in the worst cases, they are permanently unavailable in all hospitals in some KSA health regions (MOH, 2016). This resulted in around 210,000 patients being referred by their HCFs to other HCFs inside the KSA, besides 3,483 patients who were referred to foreign countries for treatment, just in 2015 (MOH, 2016).

Table 2.3: Consultant Physicians within Hospitals in Some Health Regions within KSA.

Health Regions	Tabuk	Jazan	Aljouf
Number of Hospitals	11	16	10
Speciality	Number of Physician Consultants		
Internal medicine	6	14	5
Surgery	11	20	4
Orthopaedics	3	6	1
Urology	5	4	1
Cardio. surgery		1	1
Neurosurgery	2	2	1
Plastic surgery	1	1	2
E.N.T	4	3	1
Ophthalmology	2	6	3
OBS/GYN	10	6	9
Cardiology	2	4	3
Chest diseases	1	2	
Skin & venereology	1	4	1
Neurology		1	
Tropical Medicine			
Radiology	2	1	1

Health Regions	Tabuk	Jazan	Aljouf
Number of Hospitals	11	16	10
Speciality	Number of Physician Consultants		
Laboratory	6	5	2
Anaesthesia	4	7	2
Physical medicine	0	1	1
Paediatrics	7	17	2
Psychiatry	2	2	1
Forensic M.			
Family medicine	1	3	1
Emergency			
Intensive care	1	1	1
Nephrology	1	3	
Paediatric surgery		1	1
Blood diseases		1	
Gastroenterology		3	
Endocrinology	2	1	
Oncology		1	
Vascular surgery	1	2	

The KSA relies heavily on recruiting expatriate clinical staff from abroad to cover the shortage of clinical staff in its healthcare system (76.7 % of physicians and 37.2% of nurses who were working in the KSA healthcare system in 2015 were non-Saudis (MOH, 2016)), but, even so, the KSA is unable to cover all its clinical staff needs. This is because there is a global scarcity of clinical staff, and all countries suffer from lack of them and compete for recruiting them. The WHO estimated the global shortage of clinical staff will reach 12.9m globally by 2035 (Campbell et al., 2013; WHO, 2014b). In the USA, for instance, there was a nationwide shortage of about 20,000 clinical staff in 2013 and by 2025 this shortage will be more than 159,000 (Christensen, 2013; Dill & Salsberg, 2008). There is a similar issue in the European Union (EU), which will face a shortage of 2m clinical staff by 2020 (European Commission, 2012).

Thus, there is competition between all countries to attract expatriate clinical staff who usually prefer to work in developed countries, rather than in developing countries (e.g.,

the KSA) (Chen et al., 2004). Therefore, the KSA could not compete with other countries, particularly developed countries, for attracting expatriate clinical staff, even if the KSA offers a high-pay contract for them. This is due to their concerns about several things (e.g., their professional and social life, desert climate, and the absence of recreational facilities where movies theatres, alcohol, and nightclubs are prohibited). Indeed, most of the expatriate clinical staff who work within the KSA healthcare system, during the period of their contract are looking for an opportunity to move to other countries, and they consider the KSA as a temporary location, where to obtain training, skills, practices and experience before they decide to move to other countries (Alamri et al., 2006). The turnover of expatriate clinical staff in the KSA was 32.1% and 37% in 2007 and 2015, respectively (Albejaidi, 2010; MOH, 2016). Many European and non-European countries are relying on expatriate clinical staff (e.g., in 2008, 37%, 43% and 52% of clinical staff in UK, Australia, and New Zealand healthcare systems, respectively, were expatriate clinical staff (Jensen, 2013; Gorman & Brooks, 2009)). Oman and the United Arab Emirates have much higher levels of dependence on expatriate clinical staff (above 80%) (Campbell et al., 2013).

The KSA has adopted policies to train and educate more national students to become clinical staff, but the current number of graduated Saudi clinical staff (around 6,600 yearly) is not sufficient to meet the KSA healthcare system requirements. It will take time before significant effects can be observed, particularly for physicians, since it takes usually about ten years to train a physician (WHO, 2013; Campbell et al., 2013). The KSA healthcare system currently faces a nationwide shortage of more than 40,000 clinical staff and this number is expected to become worse, as almost 37% of the nation's clinical staff are near or at retirement age (MOH, 2016; Albejaidi, 2010). Therefore, this situation necessitates the KSA to find new innovative approaches to address the shortage of clinical staff in its healthcare system. The researchers and previous studies have confirmed that telemedicine is a key tool for trying to compensate for clinical staff shortage, since telemedicine can help clinical staff make more efficient use of their time and serve more patients (Hartmann, 2014; Shah et al., 2013; Ebad, 2013; Cilliers & Flowerday, 2013).

2.4.2 The disproportionate distribution of HCFs within the KSA

As the success in providing healthcare services in a given country requires a compatible number of clinical staff in the country, it also requires a proper distribution

of HCFs within all parts of the country (OECD, 2013; Jensen, 2013). Sufficient numbers of HCFs and clinical staff at the right place are critical to deliver effective healthcare services and to improve health outcomes (Buchan et al., 2013).

The statistics of the MOH (2016) and Central Department of Statistics and Information in the KSA (CDSI) (2016) indicate that there is an improper distribution of HCFs across the KSA geographical areas. These statistics further indicate that the HCFs are concentrated in urban areas, particularly in the main cities of the KSA. According to those statistics, in 2015, while 17.6% of the KSA population lives in rural and remote areas, only 3.2% of HCFs are located on those areas (MOH, 2016; The World Bank, 2016; CDSI, 2016).

Even within the KSA urban areas, there are anomalies and a disproportionate distribution of HCFs (Alkabba et al., 2012). 85.6% of HCFs are located in two KSA urban health regions (39.2% in Riyadh and 46.4 in Jeddah, which represent only 49% of the KSA population), (MOH, 2016; The World Bank, 2016; CDSI, 2016). Also, private hospitals are not available in all KSA health regions (MOH, 2016). Alkabba et al. (2012) indicated that equity of access to healthcare resources is the second highest challenge facing the KSA inhabitants. As a consequence of this situation in the KSA, patients, particularly those who are living in rural and remote areas, currently need to travel away from home for many hours to obtain essential healthcare services (Canada Health Infoway, 2013).

There are two main reasons for this improper distribution of HCFs within the KSA. Firstly, the vast and diverse geography of the KSA. The KSA is the 13th biggest country in the world, with an area of 2.2m km^2, 150 cities and governorates, and more than 2,000 villages, and there are vast distances between them (CDSI, 2016). Secondly, most clinical staff, particularly specialists and consultants, prefer to live and practice in HCFs within urban areas. The situation is worsened by the lack of clinical staff in the KSA, which has already been outlined in 2.4.1 above.

All countries face the challenge of the improper distribution of HCFs, as the density of clinical staff and HCFs is commonly greater in urban areas around the globe (Strasser, 2003; OECD, 2013). The International Labour Organisation (ILO) indicates that, although around one half of the world's population lives in rural and remote areas, only 23% of the global clinical staff are deployed to those areas (ILO, 2015).The ILO report (2015) further finds that 56% of people living in rural and remote areas worldwide do not have access to essential healthcare services.

Scientific research and studies have shown that telemedicine is the most productive way for alleviating the challenge of an improper distribution of HCFs, and for resolving the concentration of clinical staff in urban areas (WHO, 2010; Ebad, 2013; Patel, 2014; Kachieng'a, 2011; Mars, 2013). Telemedicine, by which patients can be provided with clinical consultation and be treated miles away by healthcare providers, is particularly beneficial for groups that traditionally suffer from lack of access to healthcare (Ekeland et al., 2010). Healy (2008) indicated that by dint of telemedicine, it is now reasonable to expect that every inhabitant of our planet will be able to be treated for sickness from any location and at any time, since telemedicine would allow to provide healthcare services to patients regardless of their geographic location.

2.4.3 The growing demand for healthcare services

The demand for healthcare services within the KSA is persistently increasing, as the total number of visits to HCFs increased from 130.1m in 2011 to 138.m in 2015 (MOH, 2016). The MOH (2016) report indicates that the total number of in-patients in HCFs also increased from 3m in 2011 to 3.5m in 2015. These numbers are expected to continue rising during the next few years, due to many factors, some of which are listed as follows:

- The increase in the KSA population. The growth rate of KSA population is one of the highest in the world, and the KSA population is expected to reach approximately 40.4m in 2050 (35.1% increase compared to 2012) (CDSI, 2016; The World Bank, 2016; MOH, 2016). Furthermore, 'crude death' rate (per 1,000 population) in the KSA for year 2015 was 3.9, which is almost half the global rate (7.9).
- Demographic changes and the increase in the number of elderly people, which is compounding the situation (MOH, 2016). The number of people over 65 years old is predicted to represent 18.4% of the KSA population by 2050, while it was only 3% in 2013) (CDSI, 2016; The World Bank, 2016; MOH, 2016). Life expectancy in the KSA for the year 2015 was 74.2 years, which exceeds the Middle East and North Africa (MENA) average by 6 years, and exceeds the world average by 4 years (MOH, 2016).
- The high prevalence of communicable/infectious diseases (e.g., measles, meningitis, brucellosis, viral hepatitis B and C, etc.) and of non-communicable/chronic diseases (e.g., diabetes, obesity, etc.) among the KSA

population (MOH, 2016). A recent study revealed that 62% of generic infectious diseases in the world are endemic, or potentially endemic, to the KSA (Assiri et al., 2016). The KSA has one of the highest prevalence rates of obesity and diabetes, even in children (Alomary et al., 2016). Seventy-two percent (72.4%) and 63.5% of Saudis, over the age of 40, suffer from obesity and diabetes, respectively (Memish et al., 2014; Bahijri et al., 2016; Alomary et al., 2016; DeNicola et al., 2015).

- Providing healthcare services to pilgrims. The two holy Mosques for Muslims in Makkah and Medina attract many visitors each year, in 2015 alone, around 3.2m pilgrims performed Pilgrimage (Hajj) and 15m religious visitors performed Umrah, mostly from outside the KSA (MOH, 2016). Hajj presents unique challenges and additional burdens to the KSA healthcare system (Ahmed et al., 2006). Hajj is the biggest and most varied mass gathering of people in the world and is characterised by its annual recurrence (Memish et al., 2009; Al-Tawfiq et al., 2013). In 2015, more than 372,000 clinical staff were recruited during the Hajj season (14 days) to operate 39 hospitals and 155 PHCs at 4 main pilgrimage areas (MOH, 2016). In 2015 alone, the HCFs at 4 main pilgrimage areas provided healthcare services to around 900,000 pilgrims and conducted more than 43,000 surgery operations during the Hajj season (14 days) , free of charge (MOH, 2016).

Charrier et al. (2015) and Klaassen et al. (2016) conducted extensive studies which show how telemedicine is gaining impetus, since it provides cost-effective and useful solutions at a time when the demand for healthcare services is increasing.

2.4.4 Financing healthcare services

The WHO (2014a) indicates that all countries, even high-income countries (e.g., the KSA), are struggling to finance their healthcare systems, in order to improve or, at least, maintain their current healthcare services. In the KSA, the annual budget of the KSA healthcare system (i.e., the MOH) is usually not sufficient to meet its needs, and each year there is a shortfall in the MOH budget (Alkhamis et al., 2014; MOH, 2016). In fact, there is a continuous increase in the KSA government expenditure on healthcare, and Figure 2.2 shows the MOH budget in 2014, which is 205% higher than its budget in 2006 (WHO, 2013; MOH, 2016).

The cost of healthcare services is increased annually, worldwide, because of many factors such as costly new technologies, drugs, and advanced treatments as well as aging of the population (Monitor, 2013). In the KSA, for instance, the health expenditure per capita, as shown on Figure 2.3, increased sharply from $394 in 2004 to $946 in 2015, a 14.6% average annual increase (MOH, 2016), which is more than three times the average annual increase rate of the world health expenditure per capita (3.2% yearly) and twice the national health spending in the USA (5.8% annually) for the period 2010 through 2020 (Keehan et al., 2011; The World Bank, 2015).

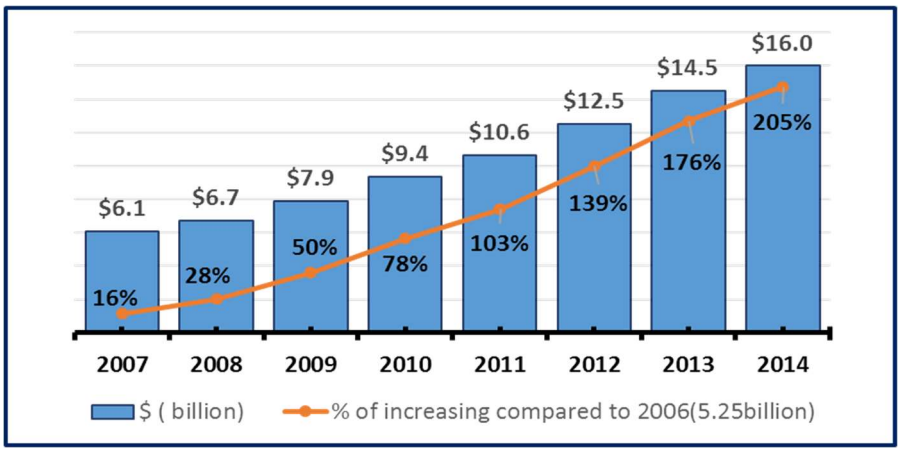

Figure 2.2 The MOH Budget in the KSA and Its Growth 2007-2014 (% Compared with 2006)

The KSA government challenge of financing its healthcare system is more complicated, since there is no taxation system in the KSA, whereas in some other countries taxation is the main source of healthcare funding. Therefore, the cornerstone of expenditure on healthcare in the KSA comes from the KSA government budget, which is derived from natural resources revenues (e.g., oil, gas, etc.) (MOF, 2016; Alkhamis et al., 2014). Such revenues are economically unreliable and risky, because they are volatile and influenced by fluctuating prices (Collier et al., 2010). Therefore, any drop in oil price leads directly to a deficit in the KSA government budget, which in turn leads to challenges in financing the healthcare system (Krimly, 1999; MOF, 2016; Albejaidi, 2010).

The KSA government is actively seeking strategies to alleviate its challenge of financing its healthcare system, however, they have not reduced the KSA government expenditure on healthcare, which has continued to increase and reached $16b in 2015 (MOH, 2016; Almalki et al., 2011). Scientific studies have shown that implementation of a telemedicine system to reduce the healthcare services' cost without compromising

access, effectiveness, and safety (Whitten, 2002; WHO, 2010; Mars, 2013; Ekeland et al., 2010; Hjelm, 2005; Dávalos et al., 2009).

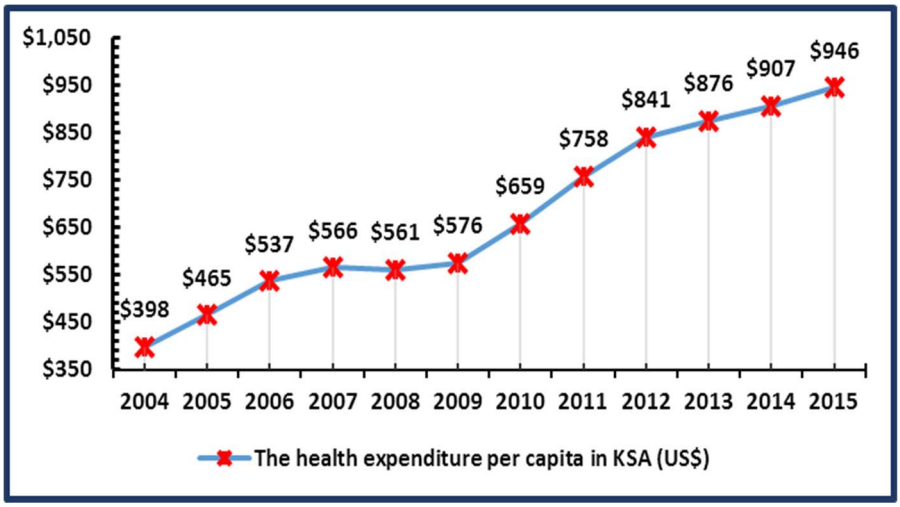

Figure 2.3 The Health Expenditure per Capita in the KSA (current US$) from 2004 to 2015

2.5 The Implementation of Telemedicine in the KSA Healthcare System

The first telemedicine application within the KSA was successfully implemented in 1994 at King Faisal Specialist Hospital and Research Centre (KFSHRC), to connect its HCFs in different provinces of the KSA (Goldberg et al., 1994). Subsequently, many telemedicine projects are being implemented by individual HCFs in the KSA. Each of them has its own telemedicine network with specific standards and limited telemedicine applications to suit its needs (and/or aims). For instance, the Saudi Arabian Ministry of Defence (MOD) established its own telemedicine network (MeduNet) in 1997, to connect only its HCFs sites in various locations within the KSA. However, there is no coordination, collaboration, or a clear communication network between individual telemedicine networks within the KSA (Canada Health Infoway, 2013). In 2010, the MOH expressed strong support for telemedicine based on a study with Canada Health Infoway (Infoway) and Ontario Telemedicine Network (OTN) into the adoption of telemedicine which had shown how telemedicine promises can alleviate many challenges of the KSA healthcare system (Canada Health Infoway, 2013). In 2011, the Saudi Telemedicine Network (STN) was launched as the first national project for telemedicine in the KSA and, as shown in Figure 2.4, its vision covered all HCFs of the KSA healthcare system; it is planned to be completed by 2020 (Canada Health Infoway, 2013). Details about the STN roadmap and some of its recommendations are provided in the following subsection.

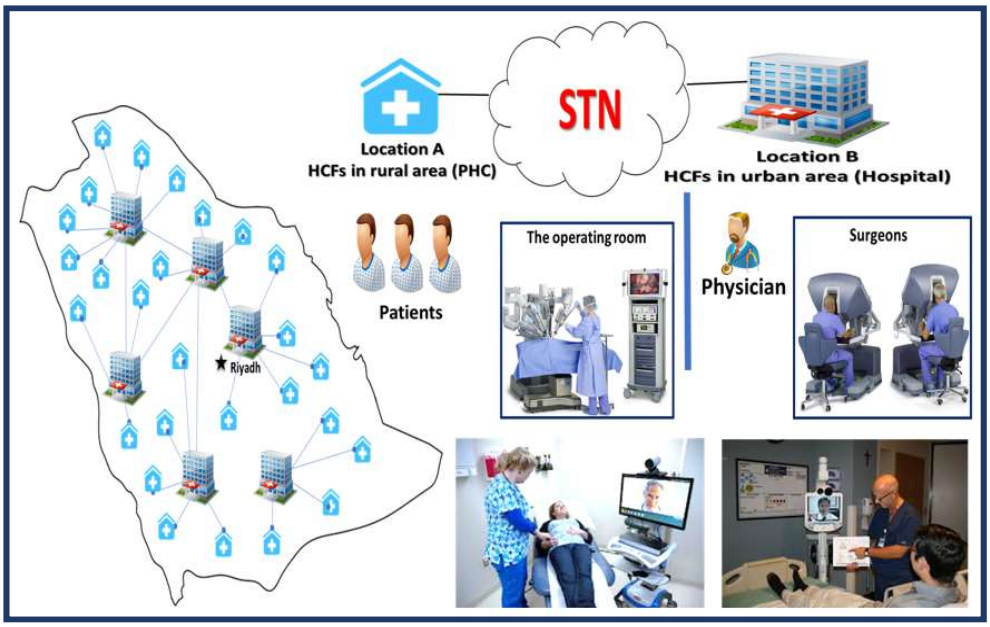

Figure 2.4 The Vision of STN

2.5.1 The Saudi Telemedicine Network (STN) roadmap and some of its recommendations

As a first step, and to ensure the successful implementation of the STN, the MOH, in 2011, cooperated with Infoway to provide guidance in the development of the STN roadmap for the KSA. The STN roadmap proposes a number of recommendations to be carried out by the MOH, the most important recommendations are listed below (Canada Health Infoway, 2013).

i. *Establishing and supporting a fully funded national-level governmental agency for the STN (STN agency), as a distinct organisation within or sponsored by the MOH, which will take responsibility for:*
   - Guiding a strategy for the development, implementation, and evaluation of the STN,
   - Directing efforts towards the STN implementation,
   - Monitoring and accrediting the STN and involved practitioners,
   - Developing and funding, on an ongoing basis, the required core infrastructure and support services, to deliver telemedicine services across the KSA (since cost is one of the critical factors that has led to unsuccessful implementation of telemedicine globally, and around 69% of HCFs in the KSA are under governmental sectors);
   - Developing key technology standards, vendor product pre-qualification processes, and national standards for security, privacy and equipment

interoperability, to which HCFs sites must adhere. This should ensure that HCFs will join together under a unified system, in which each HCF agrees to adhere to the same professional protocols and operational standards, in order to ensure security, interoperability, and that all features and capabilities are enabled across the STN. In this way, many issues related to device incompatibility could be minimised. Furthermore, standardisation brings efficiency benefits, such as better effectiveness of the technical support staff);

- Acting as a trusted party to set national-level policies and resolve national-level challenges (e.g., developing the required legal frameworks, etc.). This is necessary, since national-level challenges usually require complex interventions and extended inter-sectoral collaborations with a great diversity and heterogeneity of stakeholders from various governmental and nongovernmental organisations, each of them often coming from diverse backgrounds and with a range of priorities and agendas. Thus, a national-level governmental agency, with appropriate powers and authority, is useful to make the interventions and collaborations effective and transparent).

ii. *Leaving each HCF site to resolve by its own its organisational-level challenges relating to joining the STN, and just assisting them by promoting telemedicine adoption, focusing on knowledge transfer activities, and developing a change management plan.*

This is because of the diversity of HCFs within the KSA and their sectors. In fact, the majority of HCFs are autonomous (self-operating) and either are branches of or have collaborated (or are twinned) with different international providers. Thus, they have different barriers to and degrees of readiness for implementing telemedicine applications. Also, there are more than 6,000 HCFs, which means they need a large number of teamwork experts to equip them to join the STN, which will not exist in the STN agency.

iii. *Offering telemedicine services as web-based services.* This will mean they need less requirements (e.g., software, hardware, etc.) for working efficiently in the HCFs sites.

iv. *Grouping and categorising HCFs sites within the KSA into 22-diverse categories, based on their type, location and sector, as shown in* Table 2.4*; afterwards, making each category has different subscription requirements for*

joining the STN. For instance, the STN will require from each HCF site within (e.g., HCFs' Category 1, HCFs' Category 2, etc.) to have its own data centre, specific number of ICT staff, and its own qualified help disk staff, while each HCF site within (e.g., HCFs' Category 7, HCFs' Category 9, etc.) will be allowed to use the STN's cloud data centre and the STN help disk staff.

Table 2.4 The 22-Various Categories of HCFs Sites

HCF's location	HCF's sector	HCF's type	Category#
Urban	MOH	Medical city	1
		Hospital	2
		Specialised Clinic	3
		PHC	4
Rural	MOH	Hospital	5
		PHC	6
Urban	Military	Medical city	7
		Hospital	8
		PHC	9
Rural	Military	Hospital	10
		PHC	11
Urban	Other Gov.	Medical city	12
		Hospital	13
		PHC	14
Rural	Other Gov.	Hospital	15
		PHC	16
Urban	Private	Hospital	17
		Specialised Clinic	18
		PHC	19
Rural	Private	Hospital	20
		Specialised Clinic	21
		PHC	22

v. *Implementing the STN in a 'top-down' model and a 'centralised' approach.* This is because the STN implementation necessitates many interdisciplinary experts and researchers, which would not be possible for individual HCFs to provide. In addition, this should ensure its suitability and adaptability for each HCF site. The 'top-down' model and the 'centralised' approach will also provide many other benefits (e.g., cost-efficiency).

vi. *The STN should adopt a membership model.* Despite the benefits of a 'top-down' model and a 'centralised' approach, these do not usually help to implement an ICT system in autonomous entities, such as the case of the HCFs in the KSA. It has been noted that they are in contrast with a sense of autonomy (independency). The decision makers of the autonomous entities usually resist any system forced on them, usually do not support its implementation, and might behave in a way

that conveys doubts to the employees and consumers of their entities. Therefore, the STN agency is advocated to adopt and encourage a 'membership' model, whereby the HCFs sites will not be forced to join the STN and they will have to make their own choices to become members.

vii. *The STN should be implemented by using a dual priority approach (a balanced approach (Horizontal and Vertical Implementation)).* Implementing the STN and developing its capacity, as well as connecting the HCFs sites across the KSA, could take several years due to the lack of required ICT infrastructure and supporting services. Difficulties will arise from the limited telemedicine-specific knowledge and expertise, the diversity of the stakeholders participating, and the human resource constraints within the KSA. Therefore, the STN agency will not have the necessary capacity to implement all 'in-scope' telemedicine applications and connecting all 'in-scope' to the HCFs sites across the KSA at once. As a means to realise 'quick wins' while developing the required capacity and enabling all the HCF sites across KSA, a dual priority approach/balanced approach (horizontal and vertical implementation) is suggested. Consequently, the STN agency will, initially, launch a select number of telemedicine pilot applications and connect limited HCFs sites, then over time, the STN agency will introduce additional telemedicine applications via its network and will target to enable more HCFs sites to join its network.

2.6 Review of Existing Frameworks/Models (Related Work/ State of The Art)

The literature review reveals that there is a limited number of existing organisational decision-making frameworks/models for assisting the implementation of telemedicine system in HCFs within any countries/organisations. Therefore, this section has been extended, to consider existing organisational decision-making frameworks/models for assisting the implementation of any ICT innovations, particularly Health Information Technology (HIT) (e.g., eHealth, Hospital Information Systems (HIS), telehealth, etc.) within any countries/organisations.

Although implementation and evaluation processes should go hand in hand, it has been proved that evaluation does not necessarily clarify or contribute to successful implementation (Kerzner, 2013). Therefore, in this section, all evaluation frameworks/models (e.g., (Kidholm et al., 2012), (Khoja et al., 2013), (Yusof et al.,

2008), etc.) were excluded, unless they provided a list of guidelines on the implementation of any ICT innovation. In addition, individual case study reports and systematic reviews were also excluded, unless they contained actual models, frameworks, or guidelines for implementing any ICT innovations.

One "**Applicability Limitation**" of existing frameworks/models is that each of them was developed either to be generic for implementing all ICT innovations within a country/organisation, or to be appropriate for implementing a specific ICT innovation within a given country/organisation. Baker (2012) claims that when a framework is developed to be generic, it fails to recognise and cover all context specific factors of success and failure. Thus, the more a framework becomes general, the more details are missed. Other researchers have argued that there is no one-size-fits-all framework for implementing all ICT innovations within a given country/organisation, or even for implementing a single ICT innovation for all countries/organisations (Cresswell & Sheikh, 2013; Healy, 2008; Kaplan, 2001; Ammenwerth et al., 2003; Baker, 2012). A given framework that leads to a successful implementation for one ICT innovation in a given country/organisation may not be suitable for another ICT innovation within the same country/organisation, and may not even suitable for the same ICT innovation within another country/organisation (Gilson & Raphaely, 2008; Cresswell & Sheikh, 2013; Yu, 2010; Westbrook et al., 2007). This is because although most countries/organisations are likely to face some common barriers and challenges in implementing each ICT innovation, the implementation of each ICT innovation within each country/organisation will have its own unique sets of barriers and challenges related to many characteristics, with different business drivers, needs, funding incentives, as well as with a range of priorities and agendas (Healy, 2008; Garshnek & Hassell, 1999; Gagnon et al., 2005; Cresswell & Sheikh, 2013; Canada Health Infoway, 2013; Gilson & Raphaely, 2008; Baker, 2012; Bouwman et al., 2005). These characteristics are such as:

i. The characteristics of the country/organisation context and environment (e.g., its macro-economic, culture, structure, social and political situation);
ii. The characteristics of the country/organisation implementation strategies, and plans for implementing this ICT innovations (e.g., its project plan, project processes);
iii. The characteristics of the potential users of this ICT innovation (e.g., their acceptance, attitude);

iv. The characteristics of the ICT innovation that will be implemented, and the availability of requirements for implementing it (e.g., equipment, infrastructure).

In addition, some of the barriers and challenges that limited one ICT innovation in a given country/organisation, may no longer exist, partly diminish, or become an opportunity for either another ICT innovation or another country/organisation (Gilson & Raphaely, 2008; Baker, 2012). Therefore, each framework was developed based on the existing specific characteristics and, hence, it could not be applied to the implementation of other ICT innovations or to other countries/organisations beyond its contexts. Therefore, the ultimate success of implementing a specific ICT innovation within a given country/organisation requires this country/organisation to develop a specific framework, which should be tailored to the characteristics of both the ICT innovation and the country/organisation (Campbell et al., 2001; Perednia, 1995).

The existing frameworks/models, which are described below are generic and limited in their applicability.

2.6.1 The Human Technology Organisation Environment (HTOE) organisational decision model

Ahmadi et al. (2015) introduced the HOTE organisational decision model for adopting Hospital Information System (HIS) in Malaysian public hospitals. This model aimed at providing an informative guidance model for decision-makers and hospital practitioners when improving and promoting better decisions in adopting HIS technology in the Malaysian public hospitals context. The HTOE model, as shown in Figure 2.5, contains four dimensions (contexts) and each of them contains related latent variables that affect the Malaysian public hospitals' decision in adopting HIS, as listed below:

- Human dimension: it contains two related latent variables, which are:
    i. champion's innovativeness (the speed by which decision-makers adapt and accept new innovations), and
    ii. perceived technical competence.
- Technology dimension: it contains three related latent variables, which are:
    i. relative advantage,
    ii. compatibility, and

iii. complexity (the degree to which the ICT innovation is perceived as difficult to use).

- Organisation dimension: it contains five related latent variables which are:
  i. centralisation (the extent of participation in decision making),
  ii. formalisation (the extent of rule observance and job codification,
  iii. hospital size,
  iv. IS infrastructure (the existence of sophisticated ICT and database facilities within the organisation, and
  v. top management support.
- Environment dimension: it contains three related latent variables which are:
  i. business competition (the degree by which the organisation is influenced by its competitors in the market,
  ii. vendor support, and
  iii. government policy (the degree to which government establishes policies for a range of support and for allocating various resources in the adoption of HIS).

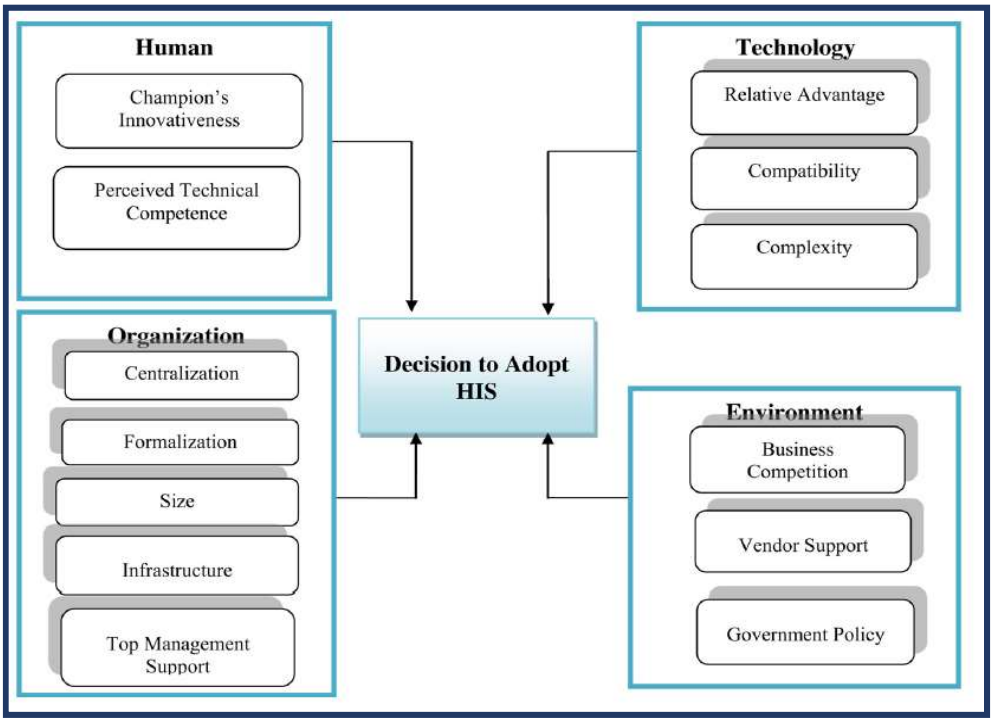

Figure 2.5 The Human Technology Organisation Environment (HTOE) Organisational Decision Model. (Source: (Ahmadi et al., 2015))

This framework has the "**Applicability Limitation**" identified and explained previously, since it was developed as a general (one-size-fits-all) framework for

implementing all HIS innovations within the Malaysian public hospitals. Another limitation is that this framework does not cover aspects related to the business-financial domain (i.e., cost and revenue), as well as other barriers related to the human dimension such as user acceptance.

2.6.2 The conceptual framework for implementing Integration Technologies (IntTech)

Kamal et al. (2015) presented a conceptual framework for implementing Integration Technologies (IntTech) within the local government authorities in the European Union (EU) member states. This framework was developed based on experience (bottom-up development approach) rather than on other existing theories (top-down development approach) (Kamal et al., 2015). This IntTech framework was developed based on empirical evidence gathered through two in-depth intensive case study explorations within two large local government agencies in the UK (Kamal et al., 2015). Four participants from each large local government agency were interviewed, using semi-structured interviews. This framework, as shown in Figure 2.6, contains three different dimensions (contexts) and each of them has factors, as listed below:

- Individual context factors focusing primarily on the individuals' behaviour, attitude, and aptitude (i.e., personality, perceptions, attitudes to risk, ethics and values, knowledge of technology, and managerial capabilities and authority).
- Decisions context focusing primarily on the decisions' type and nature (e.g., uncertainty, centralised and decentralised decision-making).
- Organisational context focusing primarily on organisational ambience and operations (i.e., culture and climate, politics, management style, and organisational compatibility).

This framework has the "**Applicability Limitation**" identified and explained previously, since it is directed to implement a specific ICT innovation (i.e., IntTech) within the EU member states context. Furthermore, it lacks a sufficiently broad scope to cover all expected dimensions, and aspects such as technological and business-financial contexts.

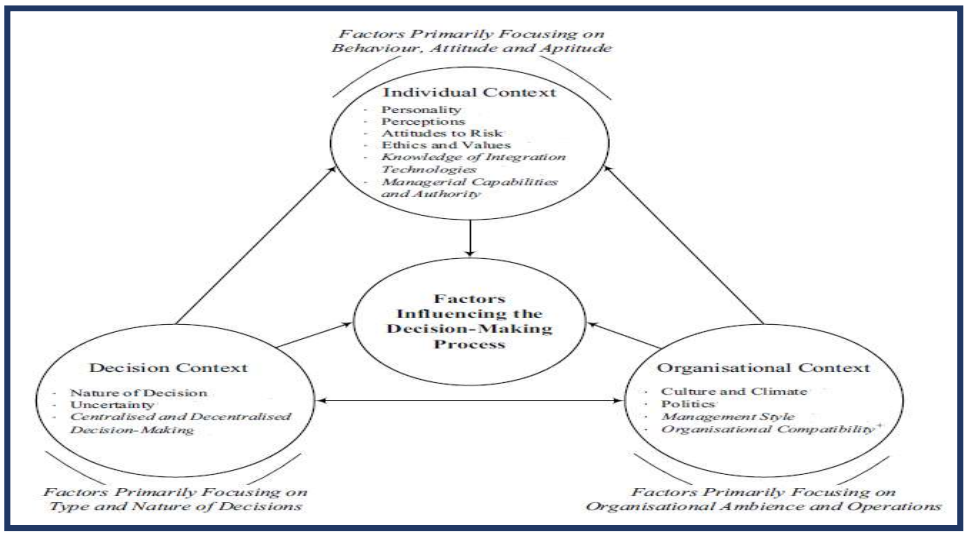

Figure 2.6 The Conceptual Framework for Implementing Integration Technologies (IntTech). (source (Kamal et al., 2015))

2.6.3 The eHealth innovation Matrix (eHix) framework

Menko et al. (2013) developed the eHealth innovation Matrix (eHix) framework, to support the implementation of eHealth innovations within the Netherlands. The eHix framework was developed based on the STOF business model framework, the innovation process, and relevant success factors for eHealth innovations within the Netherlands (Menko et al., 2013).

Four domains are covered by the eHix, which are as follows:

- The service domain describing the provided service, its added value, and the market segment at which the provided service is targeted.
- The technology domain describing the required ICT to provide this service.
- The organisation domain describing the network of organisations that together will provide the service.
- The financial domain describing the way in which these organisations will generate revenues from the provided service.

This framework has the "**Applicability Limitation**" identified and explained previously, since it was developed as a general (one-size-fits-all) framework for implementing all eHealth innovations within the Netherlands. Another limitation is that this framework does not cover all domains and aspects, such as the human domain; (i.e., human acceptance to use the proposed eHealth innovations) and availability of the required human resources for implementing the proposed eHealth innovations.

2.6.4 The organisational framework for implementing HIT within the USA (ImpHIT-USA framework)

Rippen et al. (2013) proposed a novel organisational framework for developing, optimising, implementing, and using HIT within the USA. Their framework, referred to as 'ImpHIT-USA framework', was developed by conducting a review of existing literature, including 15 related theories and models (Rippen et al., 2013). Their framework contains five major facets, which are listed as follows:

- Technology facet covering categories such as functional and non-functional requirements, interoperability, and user-based design.
- Use facet covering categories such as user attitudes, usability, ownership/buy-in, and knowledge.
- Environment facet covering categories such as teamwork climate, values, culture, governmental policies and regulations that influence the organisation, leadership, resources, and support.
- Outcomes facet covering categories such as clinical outcomes related to the use of the proposed HIT and business outcomes (cost savings).
- Temporality facet covering categories such as time, implementation cycle, and outcome lifecycle.

Once again, this framework has the "**Applicability Limitation**" identified and explained previously, since it was developed as a general (one-size-fits-all) framework for developing, optimising, implementing, and using all HIT within the USA.

2.6.5 The Telemedicine Service Maturity Model (TMSMM) framework

Dyk and Schutte (2013) presented the Telemedicine Service Maturity Model (TMSMM) framework. Their framework contains statements to measure, manage, and optimise the maturity and components of a telemedicine system, and of the South Africa healthcare system, in which it is applied. The TMSMM framework was developed based on a series of workshops held in South Africa (Dyk & Schutte, 2013). The maturity scale of the TMSMM framework is based on the stage indicators of the Capability Maturity Model (CMM) (5 stages) (Dyk & Schutte, 2013).The TMSMM framework covers five domains (5 Ms) which are defined to provide a holistic view of all the factors that influence the implementation of telemedicine

services within the South Africa healthcare system. Those five domains are as follows:

- Man (i.e., Users Communities),
- Machine (i.e., required ICT infrastructure),
- Material (i.e., required data),
- Method (i.e., work procedure service levels, national policies, strategies and ethics, guidelines), and
- Money (i.e., financial sustainability).

This framework has the "**Applicability Limitation**" described previously since it was developed to be appropriate for implementing telemedicine within the South Africa healthcare system. In addition, Carvalho et al. (2016) have argued that the development of this framework is not supported by rigorous scientific methods of conceptualisation and validation.

2.6.6 The Model for Assessment of Telemedicine (MAST)

Kidholm et al. (2012) developed a **M**odel for **As**sessment of **T**elemedicine (MAST) applications to assist decision makers of healthcare systems within Europe, for future decisions on whether or not to implement telemedicine services. The MAST was developed through workshops with users and stakeholders of telemedicine in Europe, and on the basis of a systematic literature review (Kidholm et al., 2012). The MAST is aimed at helping on evaluating information about the medical, social, economic, and ethical issues related to the use of telemedicine in a systematic, unbiased, and robust manner. The MAST focuses on specific aspects of telemedicine, such as

- Economic aspects (i.e., economic sustainability for the organisations involved);
- Perceptions of patients;
- Safety (e.g., risk of harms, loss of data, network problems, data safety, etc.);
- Organisational aspects (e.g., effects on workflow and cooperation between healthcare providers); and
- Ethical and legal aspects (e.g., the legal obligations that must be met) (Kidholm et al., 2012).

Once again, this framework has the "**Applicability Limitation**" previously identified and explained, since it was developed and validated for specific contexts (i.e., for

assisting decision makers of healthcare systems within a given region (Europe)). This study also does not include the users' dimension (i.e., clinical staff) and issues such as their acceptance.

2.6.7 The eHealth readiness assessment tools (eHRAT)

Khoja et al. (2007) developed eHealth readiness assessment tools for public and private HCFs within developing countries. Their tools were developed based on reviewing existing tools that are available in the literature, and by using participatory action research to capture stakeholders' opinions in Pakistan (Khoja et al., 2007). Their tool is for managers and is aimed at determining the readiness of four categories of the HCFs (Khoja et al., 2007). The four categories of the tools are outlined as follows:

- Core readiness assessing the HCFs readiness of key aspects (e.g., its needs, planning, suitability of technology, and integration of technology with existing services).
- Technological readiness assessing the technological readiness items (i.e., the availability and affordability of required ICT to implement a proposed eHealth program).
- Societal readiness assessing the readiness of HCFs for any interaction with other healthcare institutions in the region and beyond, such as socio-cultural factors (ICT use and interaction).
- Policy readiness assessing the readiness (or the existence) of policies at the government and organisational levels to address common issues (e.g., licensing, liability, and reimbursement).

The limitations of this framework are, firstly, the "**Applicability Limitation**" identified and explained previously, since this framework was developed as a general framework (one-size-fits-all) for implementing all eHealth systems within all developing countries. Secondly, this framework is not comprehensive, in terms of the evaluation scope and it does not have a sufficiently broad scope to cover in depth all the dimensions and aspects, such as human acceptance and availability of required human experts, and funding for implementing eHealth systems.

In conclusion, this review confirmed the following two points:

I. Firstly, that all existing frameworks share the "Applicability limitation". because each one was developed either to be generic for

implementing all ICT innovations within a country/organisation, or to be appropriate for implementing a specific ICT innovation within a given country/organisation.

II. Secondly, that to the best of our knowledge, there is not any existing organisational decision-making framework/model that has been specifically developed for assisting the implementation of telemedicine systems in HCFs within the KSA with respect to (or to be appropriate to) the telemedicine context, as well as to the context and the needs of the KSA, its HCFs, and the STN roadmap. Thus, there is a need for developing a framework to bridge this gap.

2.7 Conclusions

This chapter should help to gain an understanding of telemedicine, as well as help to provide coherency throughout the thesis. This chapter reviewed the relevant literature on which this research is based. The relevant definitions and concepts related to telemedicine are introduced. Then, the potential benefits of telemedicine and the classification of telemedicine applications are presented, as well as a brief review of the KSA healthcare system.

The challenges of the KSA healthcare system that could be alleviated by implementing telemedicine are discussed. The historical facts related to the implementation of telemedicine in the KSA healthcare system are introduced, and the Saudi Telemedicine Network (STN) roadmap and some of its recommendations are highlighted.

In the last section, previous related works on existing organisational decision-making frameworks/models were reviewed. This review shows that all existing frameworks share the "**Applicability Limitation**", since each existing framework/model was developed either to be generic for implementing all ICT innovations or to be appropriate for implementing a specific ICT innovation within a given country/organisation. To the best of our knowledge, there is not any existing organisational decision-making framework/model that has been specifically developed for assisting the implementation of telemedicine systems in HCFs within the KSA with respect to (or to be appropriate to) the telemedicine context, as well as to the context and the needs of the KSA, its HCFs, and the STN roadmap.

A variety of stakeholders' groups (e.g., HCFs across KSA, academic entities, commercial enterprises, etc.) are essential for the successful implementation of the

STN. However, the strategic-level decision makers of HCFs across the KSA are the most important stakeholders' group of the STN, and are the backbone and the cornerstone of the successful implementation of the STN. This is because the key function/goal of the STN is to provide telemedicine services to all HCFs sites across the KSA, whereby they could collaborate with one another and provide healthcare services, in particular, for those people from deprived areas which suffer severely from the lack of healthcare services (Canada Health Infoway, 2013). Therefore, the STN will not achieve its key function/goal and will not be implemented successfully unless all HCFs sites across the KSA join the STN.

Thus, this research is not aimed at developing a framework to be a rival to one of the existing frameworks, but there is a definite need for developing a novel holistic framework to bridge this gap and assisting the STN implementation. Since, regardless of the promised benefits of telemedicine and its potential technical superiority; its implementation projects are often cited as a failed project. Worldwide, 75% of such projects are abandoned or 'failed outright', and this percentage has reached 90% in developing countries (Van Dyk, 2014; Nauta et al., 2015; Kaplan & Harris-Salamone, 2009; Zailani et al., 2014; Healy, 2008).

However, the existing frameworks/models were reviewed, to derive and emanate from them useful notions that have been applied in the proposed framework. Since the proposed framework should adopt a holistic approach to cover relevant components and dimensions identified by the existing frameworks.

Chapter 3: The Theoretical Foundation and First Phase of Development of the JoinSTNassistant Framework

3.1 Introduction

As mentioned previously, the global failure rate of telemedicine implementation projects is approximately 75%, and this rate has reached 90% in developing countries. Furthermore, roughly 80% of the HIT implementation projects within the KSA healthcare system are failed projects (Abouzahra, 2011). These dramatic statistics demonstrate the great need for a suitable way or technique to assist the STN implementation and increase the likelihood of its successful implementation.

A number of authors, such as Simon et al. (2013) and Hasanain (2015), have argued that the likelihood of implementing a given ICT system successfully is increased when there is a suitable framework assisting its implementation. Employing such a framework is considered crucial for the implementation, through determining, demonstrating, and guiding its process, requirements and successful management (Cresswell et al., 2013; Simon et al., 2013; Hasanain, 2015).

In the previous chapter (Chapter 2), we argued that, to the best of our knowledge, there is not any existing framework/model that has been specifically developed for assisting the STN implementation. In addition, all the seven-reviewed existing frameworks/models are neither suitable nor effective for this purpose. Thus, this research is not intended to develop a rival to the existing frameworks, but it is aimed at developing a novel holistic framework, referred to as "JoinSTNassistant Framework", to bridge this gap.

As mentioned previously in Chapter 1 and shown in Figure 1.2, the JoinSTNassistant Framework has been developed through three-sequential phases. This chapter introduces the First Phase. Section 3.2 highlights the theoretical foundation of this research, i.e. the development of JoinSTNassistant Framework. Section 3.3 highlights the motivation and aim of this First Phase.

Section 3.4 discusses the methodology for investigating the First Phase of the development of JoinSTNassistant Framework. This explains the inclusion criteria of the studies selected from the extensive literature review, as well as the data analysis

approach and the analytical method adopted. Section 3.5 presents the data analysis steps and their findings. Section 3.6 discusses the final outcome of the First Phase.

3.2 The Theoretical Foundations of the JoinSTNassistant Framework

The seven-reviewed existing frameworks/models, which are considered in Chapter 2 (Section 2.6), presented useful notions, and their appropriate dimensions (henceforth referred to as **pillars**) and their relevant components (henceforth referred to as **barriers**) have been considered and applied in the development of JoinSTNassistant Framework. Thus, the development of the JoinSTNassistant Framework emanates and derives from a combination of those different seven-reviewed existing frameworks/models.

This combination approach has been proved to be an effective method for developing a holistic framework that could address and cover more associated pillars and their relevant barriers for the implementation of new ICT innovations. It is also better than a framework derived or emanated from a single theoretical framework/model (Oliveira & Martins, 2011; Wade et al., 2016; Green et al., 2009). This is due to the fact that there is no single theoretical framework/model that could be applied to develop a framework for all types of ICT innovations (Ammenwerth et al., 2003; Van Gemert-Pijnen et al., 2011; Ahmadi et al., 2015).

Wade et al. (2016) and Ridley (2012) have argued that a suitable theory underpinnings a research should be considered early, envisaging how the research should be conducted, and assisting in establishing an applicable and theoretically sound foundation regarding the proper literature that should be reviewed and the accurate data that should be elicited from it. By so doing, the findings and discussions of the research will be consistent with the underlying theoretical foundations, thus resulting in an effective and theoretically justified conclusion for the study (Ridley, 2012).

Therefore, suitable theories underpinning this research have been sought as the theoretical foundation and as the structured guide for the development of the JoinSTNassistant Framework. Wisdom et al. (2014), as well as Oliveira and Martins (2011), after carefully reviewing the literature, have argued that while there are many theories for predicting and explaining the behaviour or attitude of individuals towards using or implementing ICT innovations, only few organisational-level theories exist for this purpose.

The Technology–Organisation–Environment (TOE) theoretical framework, introduced by Tornatzky and Fleischer (1990), and the Diffusion On Innovation (DOI) by Rogers (2010) are the two notable organisational-level theories regarding the explanation and prediction for the implementation decision of ICT innovations within an organisation (Oliveira & Martins, 2011; Wisdom et al., 2014; Korpelainen, 2011).

The DOI theory was deliberately not chosen for this research, as it does not focus only on the context of organisational decisions regarding the implementation of a new ICT innovation, but it also focuses much more on the context of the implementation process itself (i.e., why, and at what rate) as a new ICT innovation spreads within an organisation or a country over time (Rogers, 2010; Oliveira & Martins, 2011; Venkatraman et al., 2015). This domain is beyond the scope of this research. In addition, the DOI theory was excluded because critics have argued that it pays too much attention to the role of individuals' challenges within an organisation (i.e., the role of the characteristics of individual decision makers, e.g., their innovativeness) in the diffusion of a new ICT innovation within the organisation (Rogers, 2010; Oliveira & Martins, 2011; Baker, 2012; Korpelainen, 2011). These individual-level challenges are also out of this research scope.

The TOE theoretical framework is an organisational-level theory, and focuses on assisting organisations in deciding whether to implement a new ICT innovation or not (Angeles, 2014). It has been shown to be a helpful tool in understanding the contexts and elements that may influence such organisations' decision (Angeles, 2014). More details about the TOE theoretical framework are provided as follows:

3.2.1 The Technology–Organisation–Environment (TOE) theoretical framework

The TOE theoretical framework, as illustrated in Figure 3.1, was introduced by Tornatzky and Fleischer (1990). The TOE is an organisational-level theory and explains that the process by which an organisation makes a decision to implement a given ICT innovation is influenced by three contexts, namely technological, organisational, and environmental contexts (Baker, 2012).

The technology context refers to the characteristics and the availability for the organisation of both the internal and external ICT (Rosli et al., 2012). The organisational context involves the characteristics and resources of the organisation, such as its size, managerial structure, human resources, the amount of slack resources,

and the communication processes among its employees and departments. The environmental context includes the structure and characteristics of the industry, the support of infrastructure, and the regulatory environment (Baker, 2012; Ahmadi et al., 2015). These contexts and their elements may influence the ICT innovation decision-making within an organisation. However, they are related to each other (Baker, 2012; Ahmadi et al., 2015). For instance, the communication process factor within the organisational context may be influenced by the government regulation factor within the environmental context, and so on (Baker, 2012; Ahmadi et al., 2015). Hence, the arrows in Figure 3.1 illustrate how each context is interlinked to the others and to the ICT innovation decision-making.

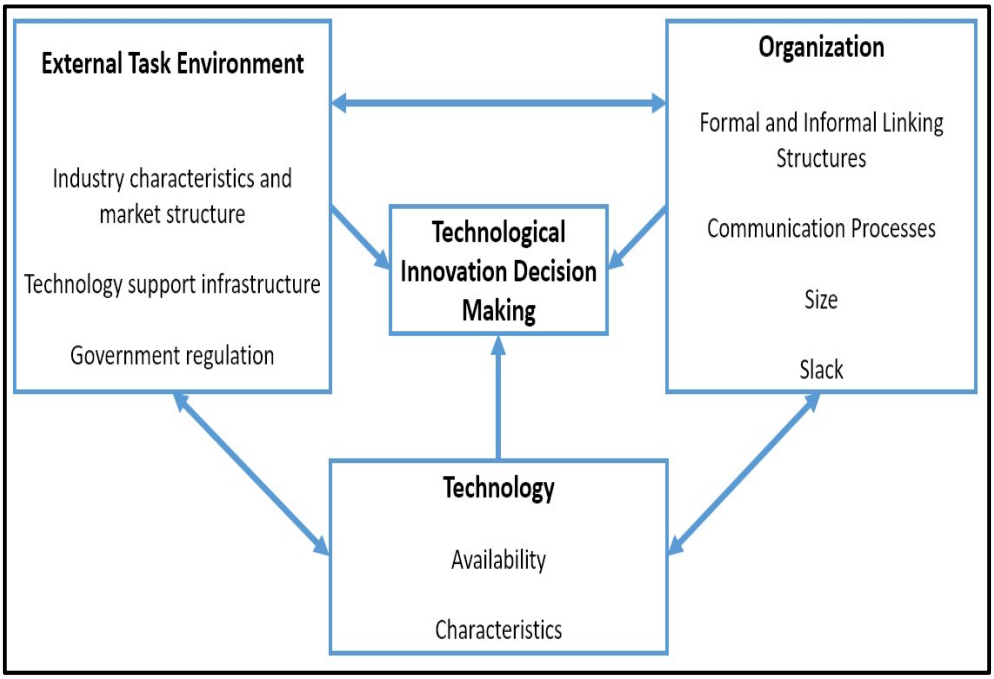

Figure 3.1 The TOE Theoretical Framework

In the implementation of ICT systems within the healthcare field, the TOE has been employed to study the implementation of various ICT innovations within HCFs. These ICT innovations include applications such as Radio Frequency Identification (RFID) (Chong & Chan, 2012; Dey et al., 2016), Cloud Computing (Lian et al., 2014), HIS (Ahmadi et al., 2017; Ismail & Abdullah, 2016), and healthcare analytics system (Venkatraman et al., 2015).

Thus, the TOE was chosen for underpinning this research and to be the theoretical foundation and the structured guide for the development of the JoinSTNassistant Framework. Therefore, the TOE assisted us in establishing an applicable and theoretically sound foundation regarding the proper literature that should be reviewed,

and the data elicited from the literature were ensured to be consistent with the TOE theoretical framework.

3.3 The Motivation and Aim of the First Phase

The concept of telemedicine implementation, and particularly the organisational-level barriers influencing its implementation decision within HCFs, are considered as almost a new topic or phenomenon in most HCFs across the KSA, which have not implemented and utilised telemedicine before. Furthermore, the STN is the first national project for telemedicine within the KSA, planned to be completed by 2020.

Due to these two facts, and after investigation and consultation with the MOH and the STN agency, it was concluded that there is a lack of decision makers with sufficient empirical experience and knowledge covering significantly all the 22-diverse categories of HCFs within the KSA. There is an utmost need for such expert decision makers, in order to identify the influential barriers regarding the decision by each HCFs' category of the KSA to join the STN. These influential barriers, in turn, must be identified for the development of the JoinSTNassistant Framework.

Reviewing the literature has proved to be a beneficial method for resolving such problems and for finding out and explaining predictive barriers related to a new phenomenon or topic (Hart, 1998; Webster & Watson, 2002; Torraco, 2005). Thus, the aim of this First Phase is the elicitation and identification from the literature review of organisational-level important predictive influential pillars and their relevant barriers, regarding the decision by HCFs of the KSA to join the STN. The final outcome of this First Phase is to produce the interim predictive version of the JoinSTNassistant Framework, in terms of its pillars and their relevant barriers.

In addition, the outcome of this First Phase would help building new knowledge and providing a clear concept, thus raising awareness for the decision makers of HCFs about the expected influential barriers and their impact to their decision to join the STN. Afterwards, their perspectives of accurate influential barriers regarding their decision to join the STN could be identified.

3.4 Methodology

Subsection 3.4.1 highlights the procedure that was used for searching the literature, as well as the inclusion criteria of the studies selected. Subsection 3.4.2 presents the data analysis approach and the analytical method adopted for analysing the data obtained from the studies selected from the literature review.

3.4.1 Inclusion criteria of selected studies

The literature was searched through web search engines and the websites of relevant governmental and non-governmental bodies. Journal indexes were also searched and relevant cited and related articles were also included by using snowball and cross-referencing methodology. Besides, the relevant documents, reports and White Papers that have been produced by governmental and non-governmental bodies were also searched, together with on-going reviews of updates taking place during this research. The initial intention was to search on literature to find studies that have investigated the barriers and challenges related to the implementation of telemedicine within the KSA or any HCFs in its healthcare system. However, the search of literature indicated that there is a limited number of these studies. To the best of our knowledge, no comprehensive scientific study has investigated these organisational-level barriers in all HCFs across KSA and at a national level. Therefore, our search has been extended to include studies that investigated the organisational-level barriers related to the implementation of HIT or any complex ICT systems within the KSA (e.g., eHealth, EHR, EMR, eCommerce, eServices, eLearning, etc.). It was also decided to include studies that investigated the organisational-level barriers related to the implementation of telemedicine or of any HIT, within other countries, particularly those close to the KSA context.

The inclusion criteria of the selected studies are as follows:

i. The study must have investigated the organisational-level barriers, challenges, and/or factors related to either the implementation of HIT or of any complex ICT systems within the KSA (e.g., eHealth, EHR, EMR, eCommerce, eServices, eLearning, etc.), OR the implementation of telemedicine or of any HIT within other countries, particularly those close to the KSA context.
ii. The study must be a primary (original) research study: i.e., the study presents findings based on any combination of the authors' observations and/or original surveys such as questionnaires or interviews.
iii. The study must be written in either English or Arabic language.
iv. The study must have been published not earlier than 2006.
v. The study can be retrieved electronically as full texts, or available locally.
vi. The scientific study must be an academic thesis, a peer-reviewed study, or a chapter from a book found in academic databases.

- ***The 56-selected studies and their categories***

After filtration and exclusion, 56 studies matched the above inclusion criteria. These 56 studies were grouped for further analysis into three diverse category sets, which are listed as follows:

i. The first category set of selected studies (Table 3.1) consisted of 23 studies: 4 were related to telemedicine implementation within HCFs in the KSA, 11were concerned with implementing any HIT or eHealth system within HCFs in the KSA (e.g., EHR, EMR, etc.), and 8 with implementing any ICT system within any organisation in the KSA (e.g., eGovernment, E-commerce, eLearning, etc.).

Table 3.1 The First Category Set of Selected Studies Related to the Implementation of Telemedicine, HIT, or ICT Systems within the KSA.

Authors & year	ICT system	The investigation strategy/method	Study code
(AlShubaily, 2014)	Telemedicine	Interviews with 20 stakeholders	KSA-TLM-01
(Ahmad et al., 2013)	Telemedicine	A questionnaire (n= 40 stakeholders)	KSA-TLM-02
(Almotiri, 2012)	Telemedicine	Interviews with 60 stakeholders	KSA-TLM-03
(El-Mahalli et al., 2012)	Telemedicine	A questionnaire (n= 251 stakeholders)	KSA-TLM-04
(AlAswad & Badewi, 2016)	EMR	A questionnaire (n= 23 decision makers) + Interviews with 19 decision makers	KSA-HIT-01
(Almuayqil et al., 2016)	eHealth	A questionnaire (n= 201 stakeholders)	KSA-HIT-02
(Khalifa, 2016)	HIS	A questionnaire (n= 153 stakeholders)	KSA-HIT-03
(Hasanain, 2015)	EHR	A questionnaire (n= 333 clinical staff) + Interviews with 9 decision makers	KSA-HIT-04
(Alsulame et al., 2015)	eHealth	Interviews with 9 experts	KSA-HIT-05
(Hasanain & Cooper, 2014)	EHR	A questionnaire (n= 30 stakeholders)	KSA-HIT-06
(Khalifa, 2014)	HIS	A questionnaire (n= 153 stakeholders)	KSA-HIT-07
(Khalifa, 2013)	HIT	A questionnaire (n= 158 clinical staff)	KSA-HIT-08
(Abouzahra, 2011)	HIT	Authors' observations and experience	KSA-HIT-09
(Khudair, 2008)	EHR	A questionnaire (n= 167 stakeholders) + interviews with 7 decision makers	KSA-HIT-10
(Alanazy, 2006)	EHR	A questionnaire (n= 480 stakeholders)	KSA-HIT-11
(Franke & Eckhardt, 2014)	eGovernment	Interviews with 3 non-Saudi experts.	KSA-ICT-01
(Almajed & Mayhew, 2013)	ICT	Interviews with 10 decision makers + A questionnaire (n= 39 decision makers)	KSA-ICT-02
(AlMajed & Mayhew, 2013)	ICT	Interviews with 10 decision makers	KSA-ICT-03
(Khan et al., 2013)	SCMS	A questionnaire (n= 52 decision makers)	KSA-ICT-04
(Alshehri et al., 2012)	eGovernment	A questionnaire (n= 460 stakeholders)	KSA-ICT-05
(AlGhamdi et al., 2012)	eCommerce	Interviews with 16 decision makers + A questionnaire (n= 80 decision makers)	KSA-ICT-06
(El-Sofany et al., 2012)	eGovernment	A questionnaire (n= 200 stakeholders)	KSA-ICT-07
(Al-Mudimigh et al., 2011)	eServices	Interviews with 16 decision makers	KSA-ICT-08

ii. The second category set of selected studies (Table 3.2) included 20 studies conducted in developing countries, particularly those close to the KSA context, such as the Middle East and North Africa regions; 9 of these studies focused on telemedicine implementation and 11 related to other HIT or eHealth systems within HCFs of those countries.

Table 3.2 The Second Category Set of Selected Studies Related to the Implementation of Telemedicine or HIT Systems within the Developing Countries, Particularly those close to the KSA Context.

Authors & year	ICT system	Geographical area	The investigation strategy/method	Study code
(Abd Ghani & Jaber, 2015)	Telemedicine	Iraq	A questionnaire (n= 30 decision makers)	UDC-TLM-01
(Keshvari et al., 2014)	Telemedicine	Iran	Interviews with 60 decision makers	UDC-TLM-02
(Buabbas, 2013)	Telemedicine	Kuwait	Interviews with 6 decision makers + A questionnaire (n= 174 stakeholders)	UDC-TLM-03
(Hussein & Khalifa, 2012)	Telemedicine	Egypt	An actuarial experience study	UDC-TLM-04
(Kachieng'a, 2011)	Telemedicine	South Africa	Interviews with 12 decision makers	UDC-TLM-05
(Kodukula & Nazvia, 2011)	Telemedicine	Maldives	18 individual-depth interviews + 5 Focus group discussions with stakeholders	UDC-TLM-06
(Isabalija et al., 2011)	Telemedicine	Uganda	10 interviews + A questionnaire (n= 150 stakeholders)	UDC-TLM-07
(Alajlani, 2010)	Telemedicine	Jordan and Syria	Interviews with 45 stakeholders + A questionnaire (n= 100 stakeholders)	UDC-TLM-08
(Meso et al., 2009)	Telemedicine	Sub-Saharan Africa	Authors' observations and experience	UDC-TLM-09
(Ahani et al., 2016)	HIT	Malaysia	A questionnaire (n=24 experts)	UDC-HIT-01
(Ahmadi et al., 2015)	HIT	Malaysia	Authors' observations and experience	UDC-HIT-02
(PHILIPS, 2015)	Telehealth	The Gulf countries	Interviews with experts, conducted by the Economist Intelligence Unit	UDC-HIT-03
(Turan & Palvia, 2014)	HIT	Turkey	A questionnaire (n= 91 decision makers.	UDC-HIT-04
(Ahmadian et al., 2014)	HIS	Iran	A questionnaire (n= 24 decision makers)	UDC-HIT-05
(Hayajneh & Zaghloul, 2012)	HIT	Arab countries	A questionnaire (n=169 stakeholders)	UDC-HIT-06
(Anwar & Shamim, 2011)	HIT	Pakistan	A questionnaire within 9 hospitals	UDC-HIT-07
(Liu, 2011)	Telecare	Taiwan	A questionnaire (n= 70 decision makers)	UDC-HIT-08
(Peng & Kurnia, 2010)	HIT	China	Interviews with 5 stakeholders	UDC-HIT-09
(Healy, 2008)	eHealth	Developing countries	Authors' observations and experience	UDC-HIT-10
(Al-Shorbaji, 2008)	eHealth	The Middle East	Authors' observations and experience	UDC-HIT-11

iii. The third and last category set of selected studies (Table 3.3) comprised 13 global studies or studies related to the developed countries, 8 of which were concerned with implementing telemedicine and 5 focused on other HIT or eHealth systems within HCFs of those countries.

Table 3.3 The Third Category Set of Selected Studies Related to the Implementation of Telemedicine or HIT Systems within the Developed Countries

Authors & year	ICT system	Geographical area	The investigation strategy/method	Study code
(Vernaglia & Lacktman, 2014)	Telemedicine	USA	A questionnaire responded by healthcare leaders most are C-level executives	DVC-TLM-01
(Shaw et al., 2013)	Telemedicine	USA	Interviews with 27 stakeholders	DVC-TLM-02
(LeRouge & Garfield, 2013)	Telemedicine	USA	Authors' observations and experience	DVC-TLM-03
(Moffatt & Eley, 2011)	Telemedicine	Australia	Interviews with 10 experts	DVC-TLM-04
(WHO, 2010)	Telemedicine	Globally	A questionnaire (n= 114 countries)	DVC-TLM-05
(Whitten et al., 2010)	Telemedicine	USA	A questionnaire (n=92 decision makers)	DVC-TLM-06
(Schwamm et al., 2009)	Telemedicine	USA	Authors' observations and experience	DVC-TLM-07
(Pak et al., 2008)	Telemedicine	Globally	Workshops (n= 335 decision makers from 209 organisations and exhibitors in 14 countries)	DVC-TLM-08
(Kuziemsky et al., 2012)	HIT	Canada	A workshop (n= 41 decision-makers)	DVC-HIT-01
(Moen et al., 2012)	eHealth	Europe	A questionnaire (n= 13 decision makers)	DVC-HIT-02
(Zikos et al., 2010)	HIT	Greek	Interviews with 18 decision makers)	DVC-HIT-03
(Khoumbati et al., 2008)	EAI	UK	Interviews with 12 decision makers	DVC-HIT-04
(Fitzgerald et al., 2008)	eHealth	UK and Spain	Interviews with 21 different groups of stakeholders	DVC-HIT-05

3.4.2 The data analysis approach and the analytical method

As mentioned in Chapter 1, the qualitative approach has been applied in this First Phase for analysing the data obtained from an extensive literature review. Numerous analytical methods can be used in qualitative research, such as thematic analysis, discourse analysis, narrative analysis, and content analysis methods (Braun & Clarke, 2006). The thematic analysis approach is the process of analysing the collected data in a scientific and clear way, in order to identify and generate common themes and patterns from it (Johnson & Wislar, 2012; Creswell, 2013; Carlin, 2016).

The content analysis approach is another method, similar to the thematic analysis approach (Braun & Clarke, 2006). However, this approach tends to focus more at a micro (i.e., individual) level, whereas the thematic analysis approach is more appropriate for exploratory analysis of themes and patterns at a macro level (Braun & Clarke, 2006). Conversely, Braun and Clarke (2006) have argued that the content analysis approach, like many other analysis approaches, is essentially the same as the thematic analysis approach, but it is claimed to be - and given a name as - something else.

There are two primary forms of the thematic analysis: data-driven (inductive) and theoretical/analyst-driven (deductive) (Braun & Clarke, 2006). The data-driven form is a procedure of coding the data without efforts to fit it into a predetermined model, i.e.: a pre-existing coding frame, for example, a specific theory(s), assumptions, hypotheses, etc. (Braun & Clarke, 2006). In contrast, the theoretical or analyst-driven (deductive) form tends to be driven by a predetermined model.

Braun and Clarke (2006) have argued that the theoretical form tends to provide more analytical details of some aspects of the collected data, but less analytical facts of the whole body of the collected data than the data-driven form. Therefore, Braun and Clarke (2006) have asserted that the qualitative thematic analysis method need to be conducted via applying these two forms sequentially. Therefore, Braun and Clarke (2006) developed a 6-step guide for conducting a qualitative thematic analysis by applying both these two forms sequentially. The summary of these 6 steps is illustrated in Figure 3.2.

Phase	Description of the process
1. Familiarising yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking in the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells; generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Figure 3.2 The Six-Step Guide of the Qualitative Thematic Analysis (Braun & Clarke, 2006)

Thus, the findings of this First Phase are obtained after the 56-selected studies from the extensive literature review have been analysed with both the data-driven (inductive) and the theoretical (deductive) forms of the thematic analysis method, (as described in Section 3.5.), by conducting the 6-step Guide of Braun and Clarke (2006). The final outcome of all these six steps is to produce the initial version of the JoinSTNassistant Framework, which reflects the final outcome of its First Phase. This final outcome is discussed and highlighted in detail in Section 3.6.

3.5 The Findings of the Six Data Analysis Steps

Section 3.5 highlights and discusses briefly the findings of each one of the 6 data analysis steps. These findings of each step are preliminary, and their purposes are just to lead to the final outcome, which is discussed and highlighted in detail in Section 3.6.

3.5.1 The first data analysis step: *'Familiarising yourself with your data'*

For the first step, all 56-selected studies were read completely, at least twice, to achieve an in-depth understanding and becoming familiar with their features, in addition, potential coding schemes were identified, in order to commence eliciting and identifying candidates' barriers in the next data analysis step.

3.5.2 The second data analysis step: '*Generating initial codes*'

For the second step, all these 56-selected studies have been uploaded into the NVivo computer software (version 11), which has been used for assisting with reliable and valid analysing and coding, whereby as many as possible candidates' barriers were elicited and identified inductively. The process of eliciting was done by a symmetrical method across all 56-selected studies, without any influence from the seven-reviewed existing frameworks/models and the TOE theoretical framework.

This process of eliciting generated a long list of different elicited candidates' barriers. In addition, data relevant to each different elicited candidates' barrier was gathered.

3.5.3 The third data analysis step: '*Searching for themes*'

In this third step, the different elicited candidates' barriers were collated/aggregated and then, sorted appropriately into different pillars. The process of sorting and aggregation was also done without any influence either from the seven-reviewed existing frameworks/models or from the TOE theoretical framework. This was a comprehensive and inclusive process of sorting and aggregation, where none of these different elicited candidates' barriers was abandoned.

The findings of this data analysis step are shown in Figure 3.3, and compose/form the initial thematic map of the JoinSTNassistant Framework, and the scope of this research. They are as follows:

i. 8 pillars: Clinical staff, Patient, ICT staff, External, Environmental, Financial, Technological, and Organisational.
ii. 63 different elicited candidates' barriers.

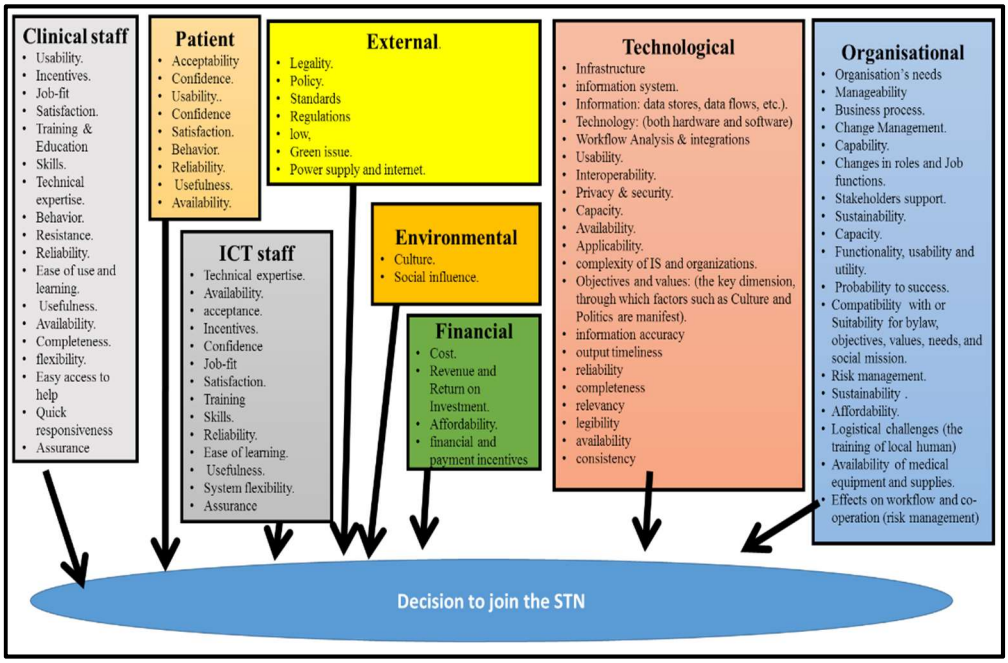

Figure 3.3 The Initial Thematic Map of the JoinSTNassistant Framework

3.5.4 The fourth data analysis step: '*Reviewing themes*'

In this step, as advocated by Braun and Clarke (2006), the analysis was moved from a descriptive to an interpretative approach by relating the findings of the third step (i.e., the 8 pillars and their 63 elicited candidates' barriers) to the seven-reviewed existing frameworks/models and to the TOE theoretical framework. This transformational procedure aimed at deriving and emanating from them useful notions that then were applied to the refinement of these 8 pillars and 63 barriers. Furthermore, this transformational procedure aimed at merging and refining these 8 pillars and 63 barriers, as to be consistent with the underpinning TOE theoretical framework.

This fourth data analysis step resulted in merging and refining these 8 pillars and their 63 elicited candidates' barriers. as follows:

i. Merging and refining 3 pillars (i.e., Clinical staff, Patient, and ICT staff) into one "**Human"** pillar, since this term covers all these three pillars' terms.
ii. Merging two pillars (i.e., External and Environmental) into one "Environmental" pillar, since there are not identifiable and evident distinctions between these two pillars
iii. Merging and refining these 63 elicited candidates' barriers to form new 22 coherent, distinctive, and consistent candidates' barriers. This was because there were no identifiable and evident distinctions between the old 63 and the selected 26 elicited candidates' barriers.

The final findings of this fourth data analysis step, as illustrated in Figure 3.4, are:

i. 5 pillars: Human, Technological, Organisational, Environmental, and Business-Financial, and
ii. 22 different elicited candidates' barriers.

These form/compose the developed thematic map of the JoinSTNassistant Framework.

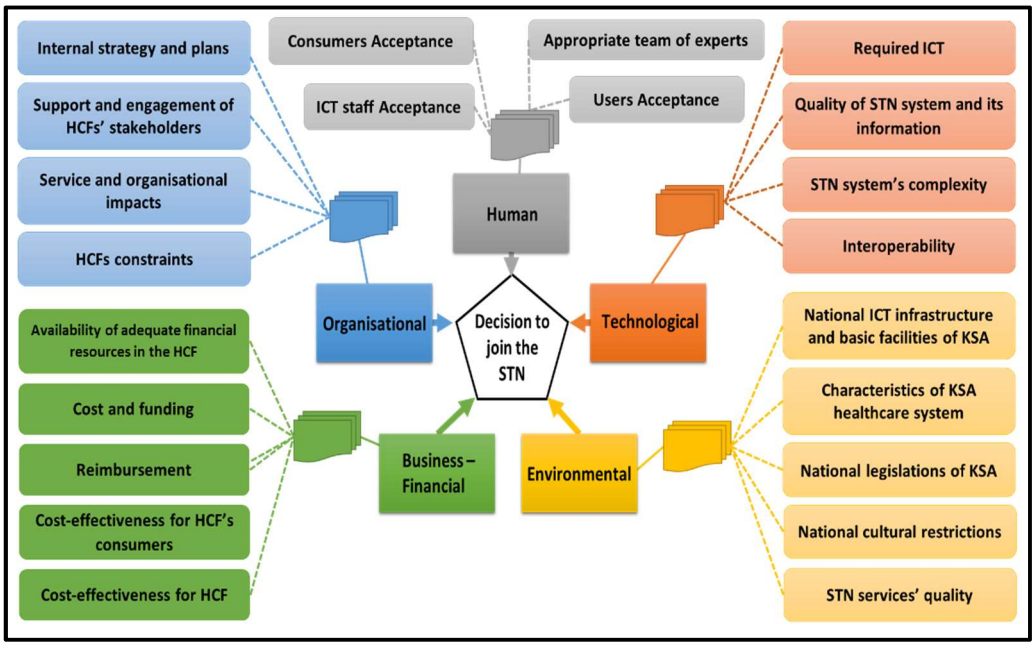

Figure 3.4 The Developed Thematic Map of the JoinSTNassistant Framework

3.5.5 The fifth data analysis step: '*Defining and naming themes*'

The fifth step refers to an ongoing analysis process, in order to further refine and define the final findings of the previous fourth step (i.e., 5 pillars and their 22 elicited candidates' barriers), and generating a clear definition and name for each of them. Therefore, the 5 pillars and their 22 elicited candidates' barriers, were further discussed and evaluated with the principal supervisor and our research team, ending up with the following decisions:

i. The 'Cost and funding' barrier within the Business-Financial pillar was deleted, because it is not appropriate to the context and the needs of the KSA and the STN roadmap. In the case of the KSA, according to the STN roadmap (2013), the KSA government fully funds the cost of the STN development, including the required core infrastructure and support services and facilities (Canada Health Infoway, 2013).
ii. Within the Business-Financial pillar, the three barriers "Cost-effectiveness for HCF's consumers", "Cost-effectiveness for HCF",

and "Reimbursement" were aggregated and refined into a new barrier, "Economic feasibility and justifiability of join the STN", because the new barrier's term covers all the three terms.

iii. Within the Human pillar, the three barriers "Users acceptance", "Consumers acceptance", and "ICT staff acceptance" were aggregated and refined into a new barrier, "Human acceptance", because the new barrier's term covers all their terms.

The 5 pillars (i.e., Human, Technological, Organisational, Environmental, Business-Financial) were kept as they are, because there are identifiable and evident distinctions between them. Furthermore, they are the scope of this research.

Thus, the findings of this data analysis step, as seen in Figure 3.5, compose/form the initial thematic map of the JoinSTNassistant Framework, and are as follows:

- 5 pillars: Human, Technological, Organisational, Environmental, Business-Financial. These 5 pillars are the 5 pillars of the final thematic map of the JoinSTNassistant Framework, and of the scope of this research.
- 17- relevant elicited candidates' barriers, which form or compose the 17 barriers of the 5 pillars of the final thematic map of the JoinSTNassistant Framework, and of the scope of this research.

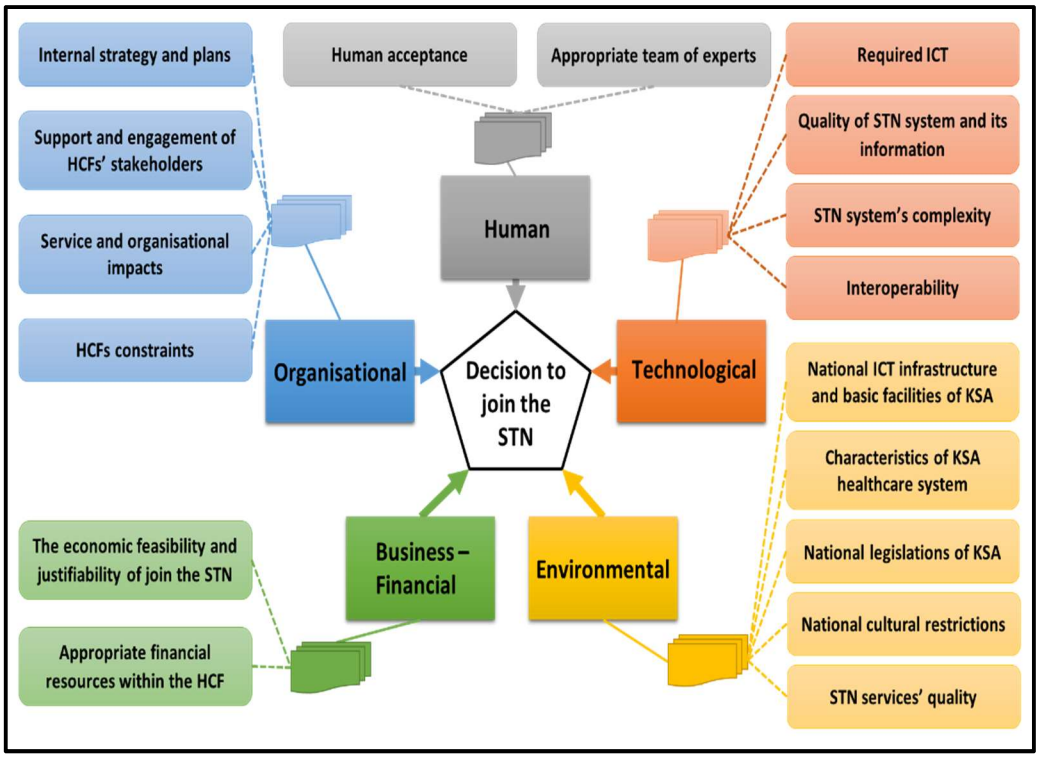

Figure 3.5 The Final Thematic Map of the JoinSTNassistant Framework

3.5.6 The sixth data analysis step '*Producing the report*'

This sixth data analysis step involves producing a report of the final findings of the previous five data analysis steps. Therefore, the following tables are produced:

i. Table 3.4 shows the final 5 pillars and each one of their 17-revelant barriers against its code.

Table 3.4 The Final 5 Pillars and Each of their 17-Relevant Barriers Against its Code

The pillar	Its relevant barrier	Code
Human	Human acceptance.	**Hu1**
	Appropriate team of experts.	**Hu2**
Organisational	Support and engagement of HCFs' stakeholders.	**Or1**
	Internal strategy and plans.	**Or2**
	HCFs constraints.	**Or3**
	Service and organisational impacts.	**Or4**
Technological	Required ICT	**Te1**
	Quality of STN system and its information	**Te2**
	STN system's complexity	**Te3**
	Interoperability.	**Te4**
Environmental	National cultural restrictions.	**En1**
	National legislations of KSA.	**En2**
	Characteristics of KSA healthcare system	**En3**
	National ICT infrastructure and basic facilities of the KSA	**En4**
	STN services' quality	**En5**
Business-financial	Appropriate financial resources within the HCF	**BF1**
	The economic feasibility and justifiability of join the STN	**BF2**

ii. Table 3.5 illustrates how the final 5 pillars and each one of their 17-revelant barriers derived and emanated from a combination of those different seven-reviewed existing frameworks/models.

Table 3.5 The Final 5 Pillars and Each of their 17-Relevant Barriers Against the 7-Reviewed Existing Frameworks/Models

The pillar	Its relevant barrier Code	The seven-reviewed existing and frameworks/models						
		HTOE (Ahmadi et al., 2015)	IntTech (Kamal et al., 2015).	eHix (Menko et al., 2013)	ImpHIT-USA (Rippen et al., 2013)	TMSMM (Dyk & Schutte, 2013)	MAST (Kidholm et al., 2012)	eHRAT (Khoja et al., 2007)
Human	Hu1		✓		✓	✓		
	Hu2	✓			✓	✓		
Organisational	Or1	✓	✓	✓	✓		✓	
	Or2		✓			✓		✓
	Or3	✓	✓			✓	✓	✓
	Or4	✓	✓	✓				✓
Technological	Te1	✓		✓	✓	✓		
	Te2				✓		✓	
	Te3	✓			✓			
	Te4	✓			✓			✓
Environmental	En1				✓			✓
	En2	✓			✓	✓	✓	✓
	En3	✓			✓		✓	
	En4				✓			
	En5	✓						
Business-financial	BF1			✓	✓	✓	✓	
	BF2			✓	✓	✓	✓	✓

iii. Table 3.6 illustrates the 56-selected studies against the final 5 pillars and each of their 17-relevant barriers.

Table 3.6 The 56-Selected Studies Against the Final 5 Pillars and Each of their 17-Relevant Barriers

	#	Author(s) & year	Study code	Code of the barriers which have been therein discussed/ identified																
				Hu1	Hu2	Or1	Or2	Or3	Or4	Te1	Te2	Te3	Te4	En1	En2	En3	En4	En5	BF1	BF2
1st Category Set of Selected Studies	1	(AlShubaily, 2014)	KSA-TLM-01	✓	✓	✓	✓			✓	✓	✓								✓
	2	(Ahmed et al., 2013)	KSA-TLM-02		✓	✓				✓								✓		
	3	(Almotiri, 2012)	KSA-TLM-03	✓	✓					✓				✓		✓		✓	✓	✓
	4	(El-Mahalli et al., 2012)	KSA-TLM-04	✓			✓			✓		✓						✓	✓	✓
	5	(AlAswad & Badewi, 2016)	KSA-HIT-01	✓		✓	✓			✓	✓							✓	✓	✓
	6	(Almuayqil et al., 2016)	KSA-HIT-02			✓	✓				✓		✓	✓		✓		✓	✓	
	7	(Khalifa, 2016)	KSA-HIT-03			✓	✓	✓						✓				✓	✓	
	8	(Hasanain, 2015)	KSA-HIT-04	✓	✓	✓					✓	✓					✓	✓		✓
	9	(Alsulame et al., 2015)	KSA-HIT-05	✓	✓	✓	✓			✓			✓	✓	✓	✓				✓
	10	(Hasanain & Cooper, 2014)	KSA-HIT-06	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓			✓
	11	(Khalifa, 2014)	KSA-HIT-07	✓		✓			✓	✓	✓	✓	✓							✓
	12	(Khalifa, 2013)	KSA-HIT-08	✓	✓	✓	✓			✓	✓	✓						✓	✓	✓
	13	(Abouzahra, 2011)	KSA-HIT-09			✓	✓			✓	✓		✓	✓			✓	✓	✓	
	14	(Khudair, 2008)	KSA-HIT-10	✓	✓	✓	✓			✓	✓	✓								✓
	15	(Alanazy, 2006)	KSA-HIT-11	✓	✓						✓	✓		✓	✓				✓	✓
	16	(Franke & Eckhardt, 2014)	KSA-ICT-01		✓	✓	✓								✓			✓	✓	
	17	(Almajed & Mayhew, 2013)	KSA-ICT-02		✓	✓	✓			✓										
	18	(AlMajed & Mayhew, 2013)	KSA-ICT-03		✓	✓	✓			✓								✓	✓	
	19	(Khan et al., 2013)	KSA-ICT-04	✓	✓					✓		✓						✓	✓	✓
	20	(Alshehri et al., 2012)	KSA-ICT-05	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	21	(AlGhamdi et al., 2012)	KSA-ICT-06	✓	✓					✓				✓	✓	✓	✓			✓
	22	(El-Sofany et al., 2012)	KSA-ICT-07	✓	✓	✓	✓			✓				✓	✓		✓	✓	✓	✓
	23	(Al-Mudimigh et al., 2011)	KSA-ICT-08	✓	✓	✓	✓	✓	✓		✓									✓
% of studies discussed/ identified the barriers				**69.6%**	**73.9%**	**78.3%**	**69.6%**	**17.4%**	**8.7%**	**73.9%**	**52.2%**	**39.1%**	**21.7%**	**43.5%**	**30.4%**	**21.7%**	**26.1%**	**60.9%**	**56.5%**	**69.6%**
2nd Category Set of	24	(Abd Ghani & Jaber, 2015)	UDC-TLM-01	✓	✓	✓		✓	✓	✓						✓		✓		✓
	25	(Keshvari et al., 2014)	UDC-TLM-02	✓	✓	✓	✓	✓								✓		✓	✓	✓
	26	(Buabbas, 2013)	UDC-TLM-03	✓		✓				✓				✓	✓					✓
	27	(Hussein & Khalifa, 2012)	UDC-TLM-04	✓	✓					✓			✓	✓	✓			✓		✓
	28	(Kachieng'a, 2011)	UDC-TLM-05		✓	✓	✓			✓						✓		✓	✓	
	29	(Kodukula & Nazvia, 2011)	UDC-TLM-06	✓	✓	✓	✓			✓				✓	✓		✓	✓	✓	✓

	#	Author(s) & year	Study code	Code of the barriers which have been therein discussed/ identified																
				Hu1	Hu2	Or1	Or2	Or3	Or4	Te1	Te2	Te3	Te4	En1	En2	En3	En4	En5	BF1	BF2
	30	(Isabalija et al., 2011)	UDC-TLM-07	✓	✓					✓				✓	✓					✓
	31	(Alajlani, 2010)	UDC-TLM-08	✓	✓					✓								✓	✓	✓
	32	(Meso et al., 2009)	UDC-TLM-09		✓	✓	✓			✓				✓	✓					
	33	(Ahani et al., 2016)	UDC-HIT-01	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓			✓		✓
	34	(Ahmadi et al., 2015)	UDC-HIT-02	✓	✓	✓		✓		✓	✓	✓								✓
	35	(PHILIPS, 2015)	UDC-HIT-03		✓	✓	✓			✓	✓		✓	✓		✓		✓	✓	
	36	(Turan & Palvia, 2014)	UDC-HIT-04			✓	✓	✓	✓	✓	✓	✓	✓	✓						
	37	(Ahmadian et al., 2014)	UDC-HIT-05	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓				✓		✓
	38	(Hayajneh & Zaghloul, 2012)	UDC-HIT-06	✓	✓	✓									✓			✓	✓	✓
	39	(Anwar & Shamim, 2011)	UDC-HIT-07	✓	✓		✓	✓		✓			✓	✓				✓	✓	✓
	40	(Liu, 2011)	UDC-HIT-08	✓	✓	✓	✓		✓	✓			✓	✓	✓			✓	✓	✓
	41	(Peng & Kurnia, 2010)	UDC-HIT-09	✓	✓	✓								✓	✓			✓	✓	✓
	42	(Healy, 2008)	UDC-HIT-10	✓	✓		✓			✓	✓	✓		✓		✓		✓	✓	✓
	43	(Al-Shorbaji, 2008)	UDC-HIT-11	✓	✓		✓			✓	✓	✓		✓	✓			✓	✓	✓
% of studies discussed/ identified the barriers				**80.0%**	**85.0%**	**70.0%**	**60.0%**	**35.0%**	**25.0%**	**85.0%**	**35.0%**	**25.0%**	**35.0%**	**65.0%**	**50.0%**	**25.0%**	**5.0%**	**75.0%**	**55.0%**	**80.0%**
3rd Category Set of Selected Studies	44	(Vernaglia & Lacktman, 2014)	DVC-TLM-01	✓		✓					✓			✓	✓			✓	✓	✓
	45	(Shaw et al., 2013)	DVC-TLM-02	✓	✓			✓	✓			✓	✓							✓
	46	(LeRouge & Garfield, 2013)	DVC-TLM-03	✓	✓		✓			✓	✓			✓				✓	✓	✓
	47	(Moffatt & Eley, 2011)	DVC-TLM-04		✓					✓						✓		✓	✓	
	48	(WHO, 2010)	DVC-TLM-05	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	49	(Whitten et al., 2010)	DVC-TLM-06	✓		✓	✓	✓	✓	✓	✓		✓		✓			✓	✓	✓
	50	(Schwamm et al., 2009)	DVC-TLM-07			✓		✓	✓		✓			✓				✓	✓	
	51	(Pak et al., 2008)	DVC-TLM-08	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
	52	(Kuziemsky et al., 2012)	DVC-HIT-01	✓	✓	✓	✓			✓	✓		✓		✓		✓	✓	✓	✓
	53	(Moen et al., 2012)	DVC-HIT-02	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	54	(Zikos et al., 2010)	DVC-HIT-03	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓		✓
	55	(Khoumbati et al., 2008)	DVC-HIT-04	✓		✓				✓	✓				✓					✓
	56	(Fitzgerald et al., 2008)	DVC-HIT-05	✓		✓					✓	✓	✓	✓					✓	✓
% of studies discussed/ identified the barriers				**84.6%**	**53.8%**	**76.9%**	**53.8%**	**38.5%**	**46.2%**	**69.2%**	**76.9%**	**38.5%**	**53.8%**	**61.5%**	**61.5%**	**23.1%**	**15.4%**	**76.9%**	**76.9%**	**84.6%**

iv. Table 3.7 depicts the alignment of the final 5 pillars and of their 17 barriers with the scopes of the three pillars and relevant barriers of the TOE theoretical framework, which is the theoretical foundation underpinning this research.

Table 3.7 The Alignment of Initial Version of the JoinSTNassistant Framework with the TOE Theoretical Framework

JoinSTNassistant Framework		**TOE theoretical framework**	
Pillar	**Its relevant barriers**	**Its relevant barriers' scopes** (Baker, 2012; Tornatzky et al., 1990; Dey et al., 2016; Lian et al., 2014; Ahmadi et al., 2017; Ismail & Abdullah, 2016; Venkatraman et al., 2015)	**Pillar**
Technological	Required ICT	Availability	**Technology**
	Quality of STN system and its information	Characteristics	
	STN system's complexity		
	Interoperability		
Organisational	Support and engagement of HCFs' stakeholders	Communication processes	**Organisation**
	Internal strategy and plans	-	
	HCFs constraints	Size	
	Service and organisational impacts.	Formal and informal linking structure	
Business-financial	Appropriate financial resources within the HCF	Slack	
	The economic feasibility and justifiability of join the STN		
Human	Appropriate team of experts		
	Human acceptance	-	
Environmental	National legislations of KSA	Government regulation	**External Task Environment**
	Characteristics of KSA healthcare system	Industry characteristics and market structure	
	National ICT infrastructure and basic facilities of the KSA	Technology support infrastructure	
	STN services' quality		
	National cultural restrictions	-	

3.6 Discussion of The Final Outcome of The Six Data Analysis Steps

This section highlights and discusses the qualitative Findings of this First Phase. The First Phase findings were obtained after the 56-selected studies from the extensive literature review were analysed by conducting the 6-step guide of Braun and Clarke (2006), and therefore applying both the data-driven (inductive) and the theoretical (deductive) forms of the thematic analysis method.

The first three of the six data analysis steps were applied for analysing the 56-selected studies from the extensive literature review. This was because as many as possible barriers were sought to be elicited and identified from the obtained data of the 56-selected studies, rather than making them fit into a predetermined model.

This resulted in finding 8 pillars and 63 different elicited candidates' barriers, which form/compose the initial thematic map of the JoinSTNassistant Framework, as outlined in Subsection 3.4.5.

Starting from the fourth step, the theoretical (deductive) form of the thematic analysis method was applied. In the fourth and fifth steps, the analysis was moved to an interpretative approach, by relating the findings of the third step (i.e., 8 pillars and 63 barriers) to the seven-reviewed existing frameworks/models and to the theoretical foundation underpinning this research (i.e., the TOE theoretical framework). This allowed deriving and emanating useful notions that were applied in the refinement of the findings of the previous data analysis steps. In addition, this transformational procedure aimed at merging and refining those 8 pillars and their 63 barriers, as required for being consistent with the TOE theoretical framework. Therefore, in the fourth and fifth step, several of those 8 pillars and 63 barriers were merged and refined, resulting in 5 pillars (i.e., Human, Technological, Organisational, Environmental, Business-Financial) and 17-relevant elicited candidates' barriers, which form/compose the final thematic map of the JoinSTNassistant Framework.

This final thematic map of the JoinSTNassistant Framework reflects the initial version of the JoinSTNassistant Framework, as shown in Figure 3.6.

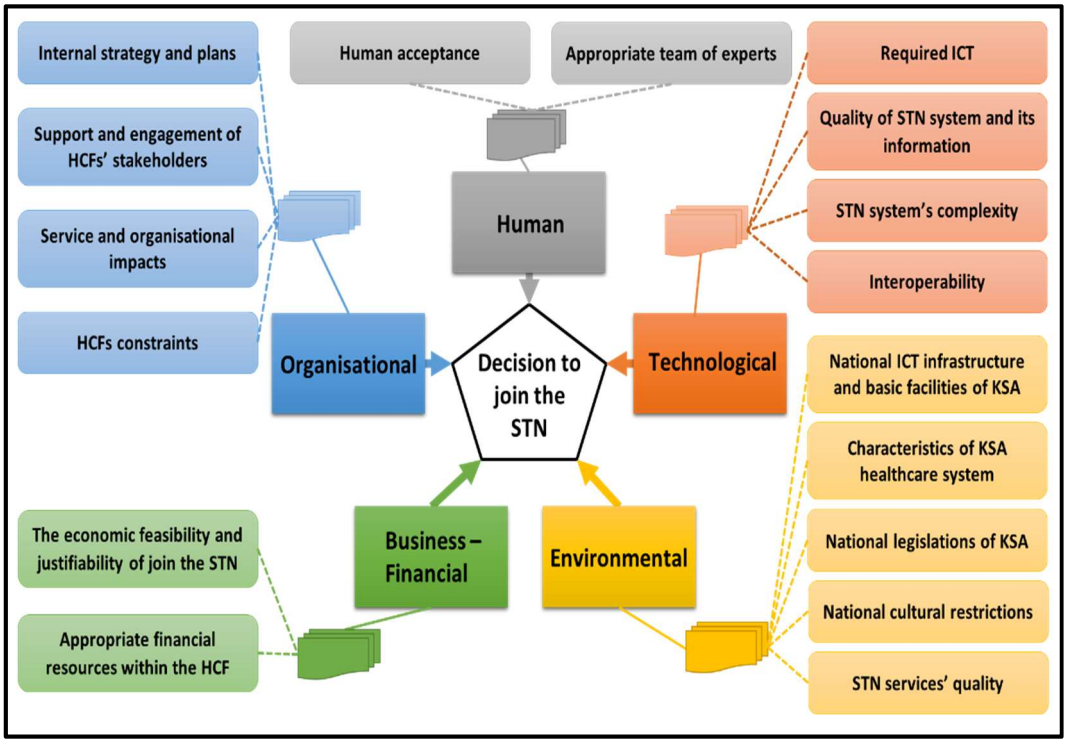

Figure 3.6 The Initial Version of the JoinSTNassistant Framework

In the following subsections, each of the 5 pillars and 17-relevant barriers of the initial version of the JoinSTNassistant Framework is discussed separately.

This has been proved helpful for building up a full concept for each of them, since it groups together the contributions from different studies (i.e., research backgrounds) (Greenhalgh et al., 2008). Of course, each researcher from a different background normally investigates and judges the subject differently, by employing different methods and utilising different criteria (Greenhalgh et al., 2008).

3.6.1 Human pillar

The term "Human" in this research refers to all types of involved humans who are necessary for implementing, using, operating, or benefiting from telemedicine systems that are provided by the STN (e.g., the clinical staff in the HCFs and the citizens/patients, the ICT staff, etc.).

In the context of telemedicine, clinical staff (i.e., physician, nurse, allied health personnel) are commonly considered users, while citizens/patients are considered consumers (Menachemi et al., 2004; Abera et al., 2014). Hence, in this research, the term "user" refers to clinical staff of the HCFs within KSA, while the term "consumer" refers to citizens/patients of the HCFs across the KSA who are diagnosed or treated via telemedicine.

As Figure 3.7 shows, in the Human pillar, two of the important, predictive and influential organisational-level barriers have been elicited from the 56-selected studies of the extensive literature review as follows:

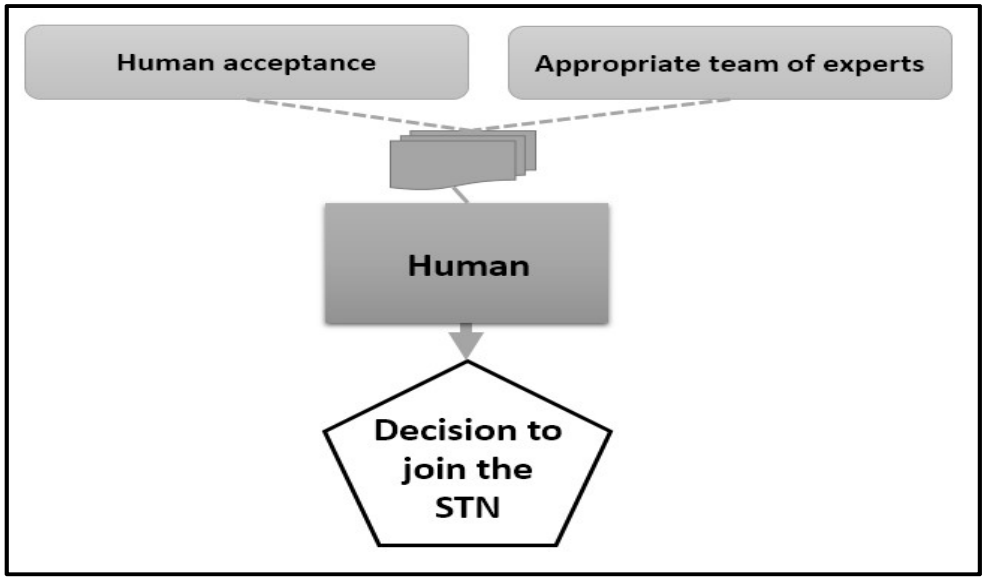

Figure 3.7 The Important, Predictive and Influential Organisational-Level Barriers of the Human Pillar

- ***Human acceptance***

The lack of understanding human acceptance of a given ICT innovation is one of the most pervasive challenges, leading to more than 40% failure of its implementation (Kijsanayotin et al., 2009; Brewster et al., 2014; Alajmi et al., 2013; Keshvari et al., 2014).

Hassibian and Hassibian (2016) have argued that a successful implementation of telemedicine is dependent on the acceptance of both clinical staff (i.e., users) and their patients (i.e., consumers), since telemedicine could not be effective if its potential users and consumers were averse to utilise it. Furthermore, the human acceptance has been indicated globally as an influential barrier to implement telemedicine (WHO, 2010). It is also the case, not only within HCFs of the KSA (e.g., Prince Sultan Medical City (Ahmed et al., 2013), the HCFs in the eastern province (El-Mahalli et al., 2012), King Faisal Specialist Hospital and Research Centre (AlShubaily, 2014)), but also in HCFs within the Middle East countries, such as Kuwait (Buabbas, 2013), Jordan and Syria (Alajlani, 2010), Egypt (Hussein & Khalifa, 2012), Iran (Keshvari et al., 2014), and other countries such as Maldives (Kodukula & Nazvia, 2011), the USA (Shaw et al., 2013; LeRouge & Garfield, 2013; Vernaglia & Lacktman, 2014), Europe (Broens et al., 2007; Schwamm et al., 2009), and Australia (Moffatt & Eley, 2011).

It has also impacted on the implementation of different ICT innovations within the KSA, such as Electronic Health Record (EHR) system (Khalifa, 2013; Hasanain & Cooper, 2014), eCommerce (AlGhamdi et al., 2012), eServices (Al-Mudimigh et al., 2011), eLearning (Bingimlas, 2009), and eGovernment system (El-Sofany et al., 2012; Alshehri et al., 2012; Franke & Eckhardt, 2014).

- ***Appropriate team of experts***

According to Lian et al. (2014), the decision makers of any organisations will implement a given ICT innovation only if their organisation has adequate number of experts as required to implement, operate, and maintain this ICT innovation. The lack of required experts has impacted on the implementation of telemedicine within HCFs of many countries such as the KSA (AlShubaily, 2014; Ahmed et al., 2013; Alaboudi et al., 2016), Kuwait (Buabbas, 2013), Egypt (Hussein & Khalifa, 2012), Iran (Keshvari et al., 2014), developing countries (Alajmi et al., 2013; Zailani et al., 2014), Maldives (Kodukula & Nazvia, 2011), and the USA (Shaw et al., 2013; LeRouge & Garfield, 2013).

The literature review has also shown that this lack has impacted on the implementation of eHealth and HIT within many countries such as Pakistan (Anwar & Shamim, 2011) and the rural settings in Canada (Kuziemsky et al., 2012).

3.6.2 Organisational pillar

In this thesis, the term "organisation" refers to all HCFs sites across the KSA that are targeted to join the STN. The Organisational pillar in the JoinSTNassistant framework deals with the internal context of the HCFs sites across the KSA.

As Figure 3.8 shows, in the Organisational pillar, 4 important, predictive and influential organisational-level barriers have been elicited from the 56-selected studies of the extensive literature review, as follows:

- ***Internal strategy and plans***

The studies have shown that, to ensure a successful implementation, the internal strategy and plans (e.g., change management plan, project management plan, strategic plan, etc.) should be in place, and their lack has been repeatedly reported as a major barrier (Bjaalid et al., 2015; Larsen et al., 2016). For instance, in the KSA, this lack has impacted on the implementation of the tele-ICU system by King Faisal Specialist Hospital and Research Centre (AlShubaily, 2014) as well as on the implementation of

HIT (Khalifa, 2013) and the HER system (Khudair, 2008) within HCFs across the KSA. Similarly, this lack has hindered the adoption of : (i) eGovernment (El-Sofany et al., 2012; Alshehri et al., 2012; Franke & Eckhardt, 2014), (ii) eLearning (Bingimlas, 2009), (iii) eServices (Al-Mudimigh et al., 2011), and (iv) ICT projects (Almajed & Mayhew, 2013) within various organisations across the KSA.

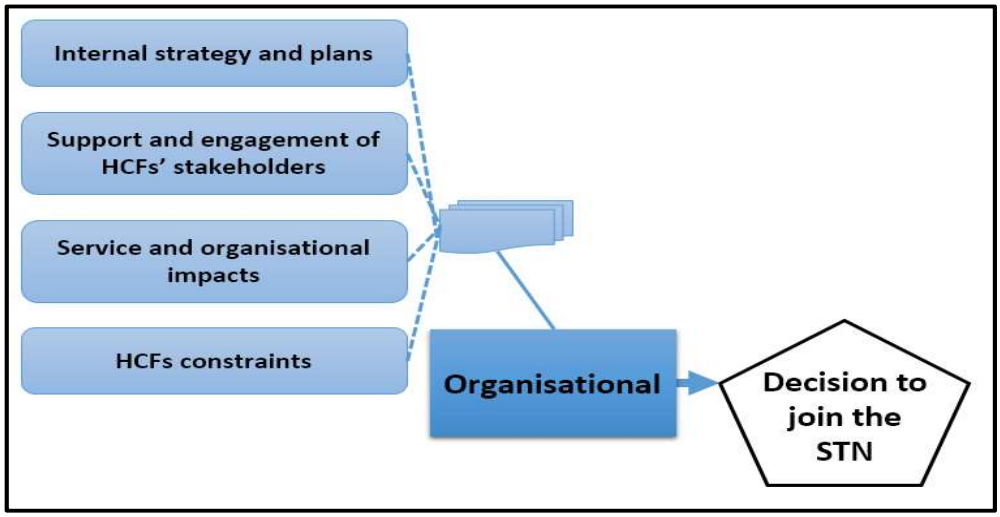

Figure 3.8 The Important, Predictive and Influential Organisational-Level Barriers of the Organisational Pillar

In the studies that were conducted on the context of different countries, the lack of internal strategy and plans within HCFs has also been cited as an influential barrier in the implementation of telemedicine within HCFs in Iran (Keshvari et al., 2014), the rural areas of South Africa (Kachieng'a, 2011), and the USA (LeRouge & Garfield, 2013; Whitten et al., 2010).

- ***Support and engagement of HCFs' stakeholders***

Many researchers such as Ross et al. (2016) have argued that the implementation of any complex ICT innovation within an organisation often requires major modifications in the existing workflows, business processes, job descriptions, and/or bylaw. In addition, it often requires providing the necessary technical support and training for the staff to gain the required knowledge to use this complex ICT innovation (Ross et al., 2016). Therefore, to ensure a successful implementation, stakeholders support and engagement are required for making any required modifications, as well as for providing the necessary training for the staff to be able to use this complex ICT innovation (Ross et al., 2016). Furthermore, Khalifa (2013) has noted that there are two most important barriers that hindered the implementation processes of Electronic

Medical Record (EMR) system within the hospitals of the KSA; one relates to the hospital management, which does not accept redesigning (i.e., reengineering) their hospital workflow to match with the EMR system, and the other is the lack of providing the necessary training for the staff to be able to use the EMR system (Khalifa, 2013).

The lack of stakeholders support and engagement has further been a challenging factor for the implementation of telemedicine within many countries such as Kuwait (Buabbas, 2013), Iran (Keshvari et al., 2014), and Malaysia (Zailani et al., 2014). It has also hindered the implementation of ICT projects (Almajed & Mayhew, 2013), eGovernment (Franke & Eckhardt, 2014; Alshehri et al., 2012; El-Sofany et al., 2012), and eServices (Al-Mudimigh et al., 2011) within organisations across the KSA.

The lack of communication, or its complexity and difficulty, among stakeholders has been indicated by many studies as an influential challenge to the implementation decision of ICT innovations within an organisation. For instance, Khudair (2008) has argued that the communication gap between stakeholders (i.e., managers, IT/Records Managers, and physicians) is the real cause of the slow spread of the EHR system within HCFs across the KSA. Almajed and Mayhew (2013) have also cited that the absence of clear communication processes is one of the main factors that negatively influences IT projects success within the KSA. Kodukula and Nazvia (2011) have also indicated that the lack of strong communication among the stakeholders is a challenge surrounding telemedicine implementation within the Maldives. Sadoughi et al. (2013) have argued that the internal communication and clear feedback among all stakeholders is a factor which influences the success of HIT implementation globally.

- ***Service and organisational impacts***

In healthcare, the empirical studies have clarified that the organisational decision to implement any ICT innovations is driven by justifiable motivations (Sadoughi et al., 2013; Kruse et al., 2014). Hence, the HCFs should decide to implement a given ICT innovation only if it would improve the HCFs performance in terms of workflow, structure, function, profits, etc., and/or the quality and efficiency of their healthcare services (Kruse et al., 2014; Venkatraman et al., 2015). Therefore, the decision makers of any organisations (e.g., HCFs) must carefully consider and understand the extent to which their organisation and its services will be impacted by implementing and utilising the new ICT innovation (AL-Hadban et al., 2016; Kaplan & Harris-Salamone,

2009; Baker, 2012; Zanaboni & Wootton, 2012; Ahmadi et al., 2015). Thus, the decision makers of any HCFs across the KSA are expected to decide joining the STN if this joining would positively impact their HCF performance, in terms of workflow, structure, function, profits, etc. and/or the quality and efficiency of their healthcare services.

- ***The HCFs constraints***

Decision makers of any organisation are considerably affected by the organisational constraints, since they must shape their decisions to meet and comply with the formal regulations (bylaw) and constraints of their organisation (Eisenhardt & Zbaracki, 1992; Elbanna, 2006). One of the frequent reasons that has been cited in the literature review for the unsuccessful implementation of a given ICT innovation is when it does not comply with the organisational constraints, such as the existing organisational business models and strategic partners, business processes, bylaws, core mission, and vision (Kruse et al., 2014; Khalifa, 2013; Shaw et al., 2013; Cresswell & Sheikh, 2013; Chaudoir et al., 2013; Sadoughi et al., 2013; Ross et al., 2016). Therefore, compatibility with the HCFs constraints is expected to contribute a significant influence on the decision of HCFs across the KSA to join the STN.

3.6.3 Technological pillar

In this research, the term "technological" refers to both those ICT systems that are already in use at the HCFs sites within KSA, as well as to all types of those ICT required to be available and customised in the HCFs sites for joining the STN. The Technological pillar includes barriers related to the technological context (e.g., required ICT infrastructure, required equipment, etc.) that are expected to act as challenging barriers with respect to the decision of HCFs managers across the KSA to join the STN.

As Figure 3.9 shows, in the technological pillar 4 important, predictive and influential organisational-level barriers have been elicited from the 56-selected studies of the extensive literature review. The following sub-sections describe these 4 barriers:

- ***The required ICT infrastructure within the HCFs***

Telemedicine is a complex system and in order to be implemented successfully and work efficiently it needs to obtain and exchange data from various ICT systems, such as EHR system, Radiology Information System (RIS), Laboratory Information System

(LIS), and Pharmacy Information System (PIS), as well as from various ICT devices (e.g., camera, medical equipment, etc.). Therefore, telemedicine system cannot be implemented successfully and work efficiently within HCFs in the absence of these required ICT infrastructure (i.e., systems and devices). Tornatzky et al. (1990) and Baker (2012) have argued that the extent of the availability of the required ICT infrastructure does influence the implementation decision for a given ICT innovation The lack of required ICT infrastructure (i.e., systems and devices) for implementing telemedicine within the HCFs, and their inability to own them has been cited as a barrier related to the implementation of telemedicine within Prince Sultan Medical City in KSA (Ahmed et al., 2013) and the hospitals in the Eastern Province of the KSA (El-Mahalli et al., 2012).

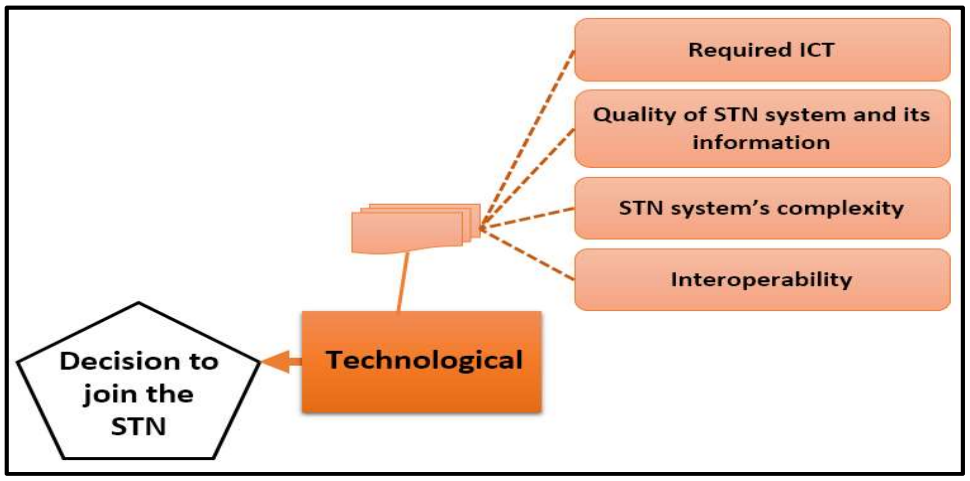

Figure 3.9 The Important, Predictive and Influential Organisational-Level Barriers of the Technological Pillar

It has also been cited as a barrier to the implementation of various ICT systems within the KSA organisations such as EHR systems (Khalifa, 2013; Hasanain & Cooper, 2014), eGovernment systems (El-Sofany et al., 2012; Alshehri et al., 2012), eCommerce system (AlGhamdi et al., 2012), and eLearning system (Bingimlas, 2009). This lack has also been cited as a barrier to the implementation of telemedicine within HCFs of different countries such as Kuwait (Buabbas, 2013), Egypt (Hussein & Khalifa, 2012), Iran (Keshvari et al., 2014), Maldives (Kodukula & Nazvia, 2011), developing countries (Alajmi et al., 2013), the USA (LeRouge & Garfield, 2013), and worldwide (WHO, 2010; Pak et al., 2008). It has also been cited as a barrier to the implementation of HIT and eHealth systems worldwide (Ross et al., 2016; Nguyen et al., 2014), in Malesia (Ahmadi et al., 2015), Turkey (Turan & Palvia, 2014), and Iran (Ahmadian et al., 2014).

- ***Quality of the telemedicine system and its information***

The high quality of an ICT system, such as usability, security, availability, reliability, efficiency, performance, and response time, is expected to improve the productivity of the individual and organisation, resulting in a positive support to implementing it (Delone & McLean, 2003; Hu, 2003). Pak et al. (2008) have argued that privacy, security and confidentiality issues are associated with both the traditional (face-to-face) healthcare delivery and the use of internet. Thus, these issues become more of a challenge when healthcare is delivered via the internet (i.e., telemedicine).

Issues related to the low quality of telemedicine systems have influenced its implementation within HCFs in the USA (Vernaglia & Lacktman, 2014; LeRouge & Garfield, 2013) and Europe (Broens et al., 2007). In addition, issues related to the low quality of the EHR system (e.g., the high failure rate and maintenance time of the EHR system (Hasanain & Cooper, 2014), and long response time (low system speed) (Khudair, 2008)) have also been indicated as barriers, and have caused the rejection of EHR implementation within HCFs across the KSA. These issues have also been acknowledged globally (Nguyen et al., 2014; Sadoughi et al., 2013) and, in particular, in Iran (Ahmadian et al., 2014), the USA (Kruse et al., 2014), and the rural settings in Canada (Kuziemsky et al., 2012). They have also impacted on the implementation decision of eHealth in Europe (Moen et al., 2012) and developing countries (Qureshi et al., 2014).

Information quality refers to the quality of the output information that is produced by the ICT system (Urbach & Müller, 2012). It can be measured in terms of the desirable characteristics of the information, such as its accuracy, completeness, usefulness, ease of understanding, and relevancy (Delone & McLean, 2003; Urbach & Müller, 2012). Nguyen et al. (2014) and Sadoughi et al. (2013) have argued that ensuring the quality of the information that is produced by the ICT system is critical to implement it in the HCFs. Almutiry et al. (2015) have argued that the quality of information provided by HIT systems, such as HER, plays an important role, and is a key challenge that influences their implementation decision within the HCFs of the KSA. Khudair (2008) has explained that the EHR system has not been broadly implemented within HCFs across the KSA because it cannot provide an acceptable quality of patients' information needed for clinical diagnosis.

Telemedicine applications obtain data from various ICT systems and sources, transmit and present them, with or without processing, to the remote clinical staff, as

meaningful or interpretable information. Therefore, from a clinical perspective, the quality of this information is essential and can profoundly affects the healthcare services rendered, as well as the individual participants (i.e., patients and clinical staff) and their HCFs (i.e., organisations).

- ***Complexity of the telemedicine applications provided by the STN***

The complexity of the telemedicine applications provided by the STN refers to the degree by which these applications are perceived by the KSA's HCFs as difficult to be implemented, operated, and/or maintained. In the studies that were conducted on the telemedicine context, the complexity of implementing, operating, and/or maintaining telemedicine has been recognised as a critical influential barrier to its implementation decision within HCFs, not only in the KSA (AlShubaily, 2014; El-Mahalli et al., 2012) but also in the USA (Zanaboni & Wootton, 2012; Shaw et al., 2013). In addition, the complexity of implementing, and maintaining HIT system, particularly the EHR system, has been identified as a critical influential barrier to its implementation decision within HCFs across the KSA (Hasanain & Cooper, 2014; Khudair, 2008; Khalifa, 2013) as well as in Iran (Ahmadian et al., 2014), Malesia (Ahmadi et al., 2015), and the USA (Kruse et al., 2014). The implementation decisions of eHealth systems have also been impacted worldwide by their complexity to be implemented, operated, and/or maintained (Ross et al., 2016; Nguyen et al., 2014), particularly in the developing countries (Qureshi et al., 2014) and in the East Mediterranean regions (Al-Shorbaji, 2008).

- ***Interoperability of the telemedicine applications provided by the STN***

Interoperability describes the extent to which two or more different ICT systems and/or devices can work together within or across organisational boundaries, in order to exchange data and interpret the data that has been exchanged (Chen et al., 2008). This is particularly relevant to the telemedicine context, which needs to exchange data with various HIT systems (e.g., EHR, RIS, LIS, PIS, etc.). Ahmadi et al. (2015) have argued that the new ICT innovation will be more feasible to be implemented within any organisation if it is interoperable with the existing ICT systems and devices of the organisation. Hasanain and Cooper (2014) argue that one of the major barriers in the implementation of EHR system within HCFs in the KSA is the inability of an EHR system to exchange information with other ICT systems already in place within HCFs.

The lack of interoperability of the new ICT system with the existing ICT systems of the organisation, has further been indicated to be a barrier facing the implementation decision of various ICT innovations such as (i) the implementation decision of telemedicine within HCFs in Egypt (Hussein & Khalifa, 2012) and the USA (Zanaboni & Wootton, 2012; Shaw et al., 2013), (ii) the implementation decision of HIT within HCFs in Iran (Ahmadian et al., 2014), Malaysia (Ahmadi et al., 2015), the USA (Kruse et al., 2014), the rural settings in Canada (Kuziemsky et al., 2012), and Turkey (Turan & Palvia, 2014), and (iii) the implementation decision of eHealth worldwide (Ross et al., 2016) and Europe (Moen et al., 2012).

3.6.4 Environmental pillar

In this research, the term "environment" refers to the external context of the HCFs within the KSA (i.e., the context of the STN, the KSA and its healthcare system, particularly the surrounding arena in which each HCFs is located and provides its healthcare services).

The literature review has clearly indicated that the environment pillar influences significantly the implementation decision of ICT innovations within an organisation. Therefore, it needs to be considered by the organisation (Baker, 2012; Rosli et al., 2012).

As Figure 3.10 shows, in the environmental pillar 5 important, predictive and influential organisational-level barriers have been elicited from the 56-selected studies of the extensive literature review. The following subsections describe these 5 barriers:

- ***Characteristics of the KSA healthcare system***

The prior studies have mentioned that the intense competition among the organisations within the same industry motivates and is a significant influence on the implementation decision of new ICT innovations within organisations (Rosli et al., 2012; Tornatzky et al., 1990). In other words, when one organisation implements a new ICT innovation, the others will do the same, to stay competitive, if it is seem to be advantageous (Baker, 2012; Tornatzky et al., 1990). In the healthcare industry, Kruse et al. (2014) have argued that the great local competition among the HCFs within the USA is a factor associated with the implementation decision of HIT within these HCFs. Liu (2011) has also mentioned that the business competition pressure is the key factor of influence on the implementation decision of telecare by HCFs within Taiwan.

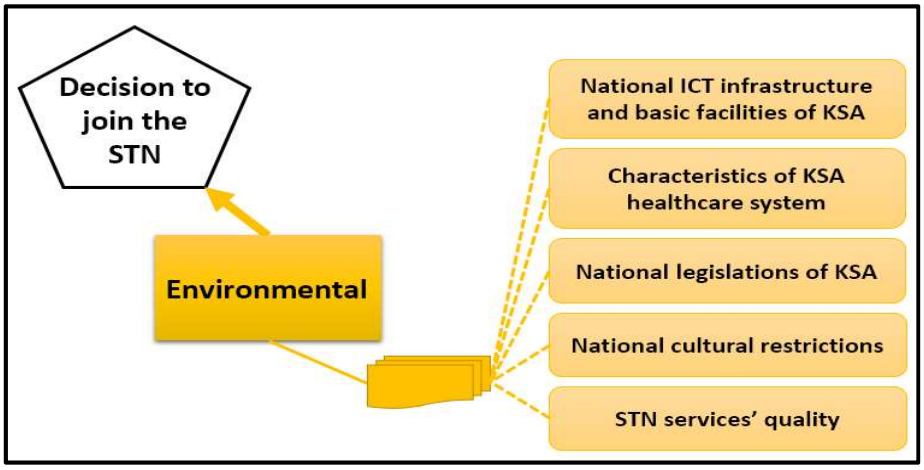

Figure 3.10 The Important, Predictive and Influential Organisational-Level Barriers of the Environmental Pillar

Further, external pressures (e.g., from government, partners, vendors, etc.) have also been indicated as a barrier that influences significantly the implementation decision of new ICT innovations within organisations (Oliveira & Martins, 2011; Curtis & Payne, 2008; Aboelmaged, 2014; Schoville & Titler, 2015). Khoumbati et al. (2008), for instance, have indicated that the external pressure from external bodies has influenced the implementation decision of EAI system within the hospitals in the UK.

Since there are various HCFs participating in the KSA healthcare system, and all of them are monitored by the MOH, the local competition among them, as well as the external pressures (e.g., from the MOH, partners, etc.), is expected to influence their decision to join the STN.

- ***Support and quality of national ICT infrastructure and basic facilities of KSA***

The empirical studies have indicated that the lack of a national ICT infrastructure and of basic facilities (e.g., electric power supplies, high internet access) within the developing countries are considered to be a barrier to the implementation of eHealth initiatives, and particularly of telemedicine, within those countries (WHO, 2010; Healy, 2008). The successful implementation of telemedicine within an organisation in a given country relies heavily on the level of quality and support of the national ICT infrastructure and of basic facilities in their country (Keshvari et al., 2014; Zailani et al., 2014; WHO, 2010). The level of quality and support also determines the types of telemedicine applications that could be implemented (Ebad, 2013; WHO, 2010). Kruse et al. (2016) have argued that the most significant barrier preventing widespread implementation of telemedicine within the rural American areas is the lack of a national ICT infrastructure and of basic facilities in those areas.

Some areas of the KSA beyond the main cities, particularly the rural and remote areas, are either out of internet connection, or suffer from slow speed internet connection and instability of electric power supplies. Almotiri (2012) has argued that the limited national ICT infrastructure and low basic facilities in the rural areas of the KSA are a barrier that influences the implementation of teleconsultation systems within the HCFs in those areas. Thus, the decision of HCFs within the KSA to join the STN is expected to be influenced by the level of quality and support of the national ICT infrastructure and basic facilities in their surrounding area.

- ***National legislations within the KSA to govern issues related to the usage of the STN***

There are several studies pointing out that the availability of national legislations (e.g., laws, policies, regulations, technology standards, liability, licensure, etc.) to govern issues related to the usage of a given ICT innovation, has a significant influence on its implementation decision within organisations (WHO, 2010; Alajmi et al., 2013; LeRouge & Garfield, 2013). In the KSA, for instance, the absence or the insufficiency of national legislations to govern issues related to the usage of eCommerce (AlGhamdi et al., 2012) and eGovernment (Alshehri et al., 2012; El-Sofany et al., 2012) have been indicated to be a barrier facing their implementation decision within organisations.

The WHO (2010) has argued that telemedicine is a complex system, so there is the possibility at any time of malfunctions, which could cause the death or increase the illness of patients treated in this way. Furthermore, telemedicine may involve more healthcare providers than conventional face-to-face treatment, and this could potentially lead to confusion as to who is accountable for individual decisions and for the overall care of the patient, as well as where liability falls. Therefore, clearly defined national legislations to govern such issues, or other malpractice issues related to telemedicine usage, are important to address and reduce HCFs concerns over the litigation risks (e.g., legal liability) and other risks (Stanberry, 2006; WHO, 2010). Almotiri (2012) has argued that the absence of regulation and legal legislation to clarify responsibility and to avoid potential malpractice or negligence complaints, is one of the barriers obstructing teleconsultation utilisation within the HCFs of the KSA. This absence of regulation and legal legislation has been indicated to be a barrier hampering the implementation decision of telemedicine worldwide (WHO, 2010; Pak et al., 2008), and particularly in developing countries (Alajmi et al., 2013). For example, in Egypt (Hussein & Khalifa, 2012), Maldives (Kodukula & Nazvia, 2011)

and in Turkey (Turan & Palvia, 2014) as well as in the USA (LeRouge & Garfield, 2013; Vernaglia & Lacktman, 2014).

- ***Ensuring and trust the STN services***

The utilisation scenario of the STN will be such that: the consulting and referring HCF site within the KSA will utilise one of the telemedicine applications that are provided by the STN agency (i.e., External Service Provider (ESP)). In this way, the consulting HCF site provides healthcare services remotely to the patient of the referring HCF site (Canada Health Infoway, 2013). In this case, each HCF site certainly needs to ensure and trust, first and foremost, the services that are delivered by the STN. Ensuring and trusting the STN services not only involves questions about the STN overall support delivered to the HCFs across the KSA, but also involves questions about the performance, supportability, stability, and functionality of the STN and its services. The literature review contains many ICT innovations whose implementation has been rejected because of issues related to the services that are delivered by their ESP. Hasanain and Cooper (2014) indicated that instability of the ESP that provides EHR system is one of the major barriers in its implementation within HCFs in the KSA. Turan and Palvia (2014) have argued that some of the HIT that are delivered by ESPs have not been implemented within HCFs in Turkey, because of distrust of the services delivered by their ESPs, which do not have disaster preparedness and recovery plans. Kuziemsky et al. (2012) have argued that ensuring the reliability of the HIT services that are delivered by the ESPs (i.e., providing 24/7 technical support) is a factor influencing its implementation decision within HCFs.

- ***National cultural restrictions***

Hofstede (2003) indicates that national culture consists of shared values, beliefs and norms. Various studies have noted that there is a connection between national culture and the implementation of a given ICT innovation (Bankole & Bankole, 2017; Alajlani & Clarke, 2013; Cresswell & Sheikh, 2013). In other words, ICT innovations will be decided to be implemented when they are consistent with the underlying beliefs, values and norms of the society in which they will serve (Sadoughi et al., 2013). Franke et al. (1991) have argued that what may work in one culture may not be appropriate in another. Leidner and Kayworth (2006) came to a similar conclusion in their study, and have noted that the major contributing barrier on the failure of implementing a given

ICT innovation, is that it is transferred from one cultural context to another new one, without understanding its compatibility and interaction with this new cultural context. In the healthcare context, the procedures for providing healthcare services via the utilisation of ICT innovations are not always in harmony with some aspects of the national culture (i.e., beliefs, norms, religious). For instance, dealing with the opposite sex when a male clinical staff has to participate in the work with a female clinical staff and vice versa. While this it is permitted in Islamic ethics and rules under specific circumstances and rules, yet the cultural and traditional beliefs of some Muslim clinical staff prohibit these dealings even via ICT (Alkabba et al., 2012). Alkabba et al. (2012) have argued that the refusing by the Muslim clinical staff to deal with the opposite sex is one of the top ten challenges facing the KSA healthcare system. In addition, patients and clinical staff, especially in the case of the women, are usually averse to being recorded/filmed and such films being shared with other clinical staff, for fear of data being lost, stolen, leaked, or seen by unauthorised persons (Almutairi, 2011; Zaidan et al., 2011).

In the Middle East (ME) countries such as the KSA, the decisions of implementing and using a new ICT system are strongly influenced by cultural, social and religious barriers (Alateyah et al., 2013; Baabdullah & Williams, 2013). Alsulame et al. (2015) have argued that religious and cultural considerations have negatively influenced the implementation decisions of eHealth systems within HCFs of the KSA.

3.6.5 Business-financial pillar

This pillar includes variables related to business-financial considerations that are expected to be challenging barriers with respect to the decision of HCFs managers across the KSA to join the STN.

As shown in Figure 3.11, in the business-financial pillar, 2 important, predictive and influential organisational-level barriers have been elicited from the 56-selected studies of the extensive literature review. The following sub-sections describe these 2 barriers:

- ***The economic feasibility and justifiability of join the STN***

Many researchers have argued that there are many possible new ICT innovations that could be implemented within the organisations for many reasons (e.g., to improve their services quality, to save money, to increase profits, etc.). However, because implementing a new ICT innovation is usually costly, the organisations, due to their limited financial resources have to determine if the ICT innovations seem to be feasible

and justifiable economically for them, before financial resources are allocated (Demirhan et al., 2005; Dávalos et al., 2009; Remenyi et al., 2007)

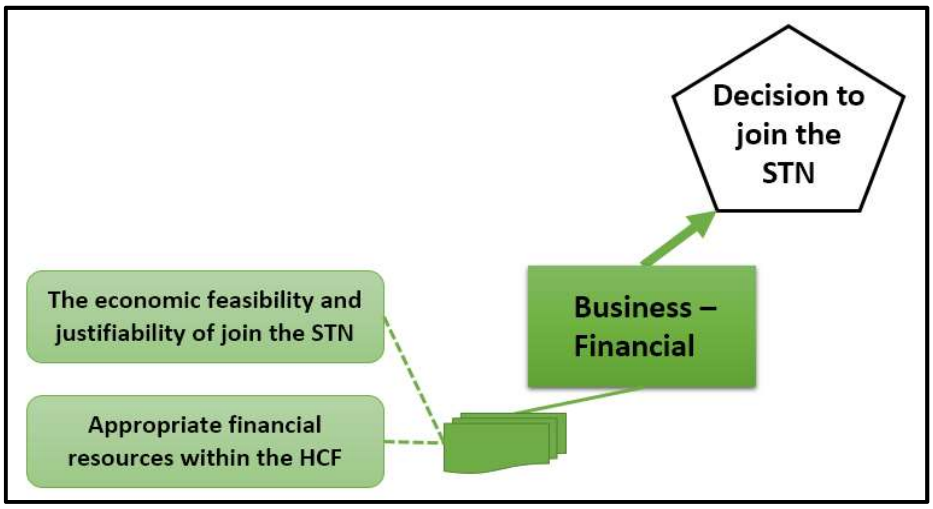

Figure 3.11 The Important, Predictive and Influential Organisational-Level Barriers of the Business-Financial Pillar

The assessment of the economic feasibility and justifiability of a given ICT innovation for the organisation, typically deals with variables that can be quantified, analysed, and measured in monetary terms by using financial methods (e.g., Cost-Benefit Analysis (CBA), Return On Investment (ROI), Payback Period (PP), etc.) (Siegel, 1996; Remenyi et al., 2007; Dávalos et al., 2009). The results of this assessment help organisations to determine the positive economic benefits to them that the proposed ICT innovation will provide (Siegel, 1996; Russell, 1996; Remenyi et al., 2007). Therefore, these results significantly influence the implementation decision of the ICT innovation within the organisation (Remenyi et al., 2007; Demirhan et al., 2005; Dávalos et al., 2009). The literature review contains many studies which identified the results of the economic feasibility and justifiability of a specific ICT innovation for the organisation, as a barrier influencing its implementation decision (Sadoughi et al., 2013; Kuziemsky et al., 2012; Healy, 2008; Khalifa, 2013). Khalifa (2013) and Sadoughi et al. (2013) have argued that the HIT will be implemented within HCFs only if they are certain about the returns on this investment. Kuziemsky et al. (2012) and Healy (2008) have indicated that the HCFs have to feel that the cost of implementing a given ICT innovation is the best cost-effective way to spend their money, rather than other needs in the HCFs (e.g., need for beds and more recruitment). The issue of reimbursement has a significant impact on the results of the notions of the economic feasibility and justifiability of implementing and using a given ICT

innovation within organisations (Kidholm et al., 2012). Experts believe that the success of telemedicine is dependent on reimbursement more than any other issues (Brewster et al., 2014). The lack of reimbursement of telemedicine services has been identified as a challenge facing the implementation decision of telemedicine within HCFs in many countries such as Egypt (Hussein & Khalifa, 2012), Iran (Keshvari et al., 2014), the USA (Schwamm et al., 2009; LeRouge & Garfield, 2013), and the European countries (Vernaglia & Lacktman, 2014; Zanaboni & Wootton, 2012). Hartvigsen (2013) has argued that for successful implementation of telemedicine services, an official policy should be in place for making all telemedicine services reimbursable by all stakeholders (e.g., the national/regional health authorities and health insurer organisations).

- ***The availability of adequate financial resources within the HCF to be equipped with the requirements necessary for joining the STN***

Implementing a complex and advanced ICT innovation such as telemedicine is very costly, since it often involves large investments in several requirements (e.g., advanced ICT infrastructure and equipment, training, etc.) (Russo et al., 2016; Coustasse, 2014; Bradford et al., 2014; Hassibian & Hassibian, 2016; Kruse et al., 2016). The WHO (2010) and Kruse et al. (2016) have mentioned that the high cost of implementing telemedicine, combined with the lack of financial resources within HCFs to implement, operate, and maintain telemedicine are the most prevalent barriers to its implementation globally.

In the case of the KSA, according to the STN roadmap (2013), the KSA government fully funds the cost of the STN development, including the required core infrastructure and support services and facilities. However, this funding does not cover the cost of equipping each HCF sites across the KSA with the requirements necessary for joining the STN and other costs such as the operating and maintaining cost of the own ICT infrastructure and equipment of each HCF sites, the staff training cost etc. (Canada Health Infoway, 2013). The WHO (2010) has argued that the cost of equipment, maintenance, and staff training for telemedicine is a daunting challenge for any HCFs. The high cost and the lack of financial resources are cited as deterrent barriers to telemedicine implementation within HCFs in the KSA (AlShubaily, 2014; Ahmed et al., 2013). Therefore, the availability of adequate financial resources within the HCF sites across the KSA, to be equipped with the requirements necessary for joining the

STN and to operate and maintain their own ICT infrastructure and equipment, is expected to be a significant barrier influencing their joining decision.

3.7 Conclusions

This chapter has achieved the finding and definition of the specification for the "First Phase" of the JoinSTNassistant Framework, which can be considered as the initial version of this Framework, and covers the predictive influential organisational-level barriers to the decision by all categories of HCFs to join the STN. This was a main aim of this chapter.

The initial version of the JoinSTNassistant Framework includes 5 Pillars and 17 Barriers. The 5 Pillars are: Hunan, Technological, Environmental, Business-Financial, and Organisational. They are shown in Figure 3.6 with their corresponding 17 Barriers.

The reliability of these findings is supported by the following three points:

i. The vast literature review performed, resulting in the selection of 56 relevant studies.
ii. The sound theoretical foundation provided by the chosen theoretical framework (TOE).
iii. The rigorous and most comprehensive methodology adopted. This was the Braun and Clarke (2006) six step qualitative thematic approach, which involved both inductive (steps 1 to 3) and deductive (steps 4 to 6) analysis.

All the pillars and barriers are discussed in detail in Section 3.5. This showed how the 17 barriers affected implementations of this kind on a global scale, but particularly in the KSA, the Middle East, developing countries, and rural or peripheral areas everywhere.

These findings constitute the input to the "Second Phase" of the three-sequential phases of the JoinSTNassistant Framework, where they are discussed and evaluated by interviews with strategic-level members of the STN-Communities of Practice (STN-CoP), for the purpose of identifying their perspectives of influential barriers regarding their decision to join the STN. This Second Phase is presented in the next chapter.

Chapter 4: Second Phase of Development of the JoinSTNassistant Framework

4.1 Introduction

The JoinSTNassistant Framework aims to assist HCFs across the KSA regarding their decision to join the STN in a scientific, effective, sensible, and realistic way. Therefore, it must be ensured that this Framework is theoretically rigorous, as well as relevant specifically to the context and the needs of the KSA, its HCFs, and the STN roadmap. To achieve this, as mentioned in Chapter 1, the JoinSTNassistant Framework has been developed through three-sequential phases.

Chapter 3 determined the First Phase, which defines and applies the theoretical and philosophical foundations of the JoinSTNassistant Framework. In that First Phase, 56-selected studies from the extensive literature review were analysed, and the final outcome identified 5 pillars and their 17-relvent barriers. Those form/compose the initial version of the JoinSTNassistant Framework.

This chapter introduces and discusses the Second Phase of development, which reflects the practical and pragmatic requirements of the JoinSTNassistant Framework. This is done by means of conducting interviews with strategic-level members of the STN-Communities of Practice (STN-CoP), with the following aims:

i. Discussing and evaluating the final outcome of the First Phase (the initial version of the JoinSTNassistant Framework) with strategic-level members of the STN-CoP, in order to:
   - Identify the perspective of each of the 22-diverse categories of HCFs regarding the important, influential strategic-level barriers with respect to their decision to join the STN.
   - Understand differences and similarities between the 22- diverse categories of HCFs regarding their perspectives.

ii. Discussing the normal decision-making process of HCFs across the KSA, and the types of information that are usually required, for the purpose of reaching a consensus for determining the following:
   - A suitable decision-assist technique(s) to be utilised by the JoinSTNassistant Framework.

- Key features that should be incorporated/considered into the JoinSTNassistant Framework.
- A measurable and tangible parameter/metric for each important influential barrier.

The final outcome of this Second Phase is to produce the developed (i.e., revised) version of the JoinSTNassistant Framework. Thus, the developed version of the JoinSTNassistant Framework will be formed/composed not only by theoretical and philosophical approaches, but also by practical and pragmatic considerations.

Section 4.2 highlights the methodology for the Second Phase. This explains the selection procedure and eligibility criteria of participants, as well as the interviews approach and the data analysis method adopted. Section 4.3 presents and discusses the findings, while Section 4.4 discusses the implications of the findings.

4.2 Methodology

4.2.1 Selection procedure and eligibility criteria of participants

In order to achieve the aims of this Second Phase, all the 22-diverse categories of HCFs within the KSA (Table 2.4) are represented by at least 3 of the potential participants. In addition, each potential participant should:

i. Belong to the strategic level (i.e., working at the top echelons of HCFs) and can influence or participate in the decision-making process of his/her HCF regarding the decision of joining the STN,
ii. Belong to one HCF, and there is no other participant belonging to the same one.
iii. Have knowledge and experience about telemedicine and its implementation, and
iv. Be willing to participate in this survey.

A list of nominated strategic-level members of the STN-CoP was provided by the STN agency and by the National eHealth Strategy and Change Management Office in the MOH. A research information document, containing a brief introduction about the research, its purpose, and the reasons for the interview, was emailed to all nominated strategic-level members of the STN-CoP, in order to invite potential participants.

Eighty-one (n=81) candidates of the strategic-level members of the STN-CoP matched the eligibility criteria and agreed to participate in this study. An introductory email was sent to all 81 potential participants. This email contained a brief introduction about this

study and its aims, the findings of the First Phase, guidelines of the interview questions, and a Consent and Non-Disclosure forms to be signed by them before the interviews. The introductory email aimed to familiarise the participants with the purpose of the interviews, so that they would have time to prepare themselves and give consideration to the questions and their responses, before the interview sessions.

Table 4.1 The 22-Diverse Categories of HCFs within KSA (Canada Health Infoway, 2013)

HCF's location	HCF's sector	HCF's type	HCF's category code
Urban	MOH	Medical city	**C01**
		Hospital	**C02**
		Specialised Clinic	**C03**
		PHC	**C04**
Rural	MOH	Hospital	**C05**
		PHC	**C06**
Urban	Military	Medical city	**C07**
		Hospital	**C08**
		PHC	**C09**
Rural	Military	Hospital	**C10**
		PHC	**C11**
Urban	Other Gov.	Medical city	**C12**
		Hospital	**C13**
		PHC	**C14**
Rural	Other Gov.	Hospital	**C15**
		PHC	**C16**
Urban	Private	Hospital	**C17**
		Specialised Clinic	**C18**
		PHC	**C19**
Rural	Private	Hospital	**C20**
		Specialised Clinic	**C21**
		PHC	**C22**

The 81participants were then categorised to form 22 homogeneous groups, based on their HCFs' category, as shown in Table 4.2. In order to provide anonymity and ensure confidentiality, the 81 participants are identified by code. The occupational positions of the 81 participants, and their corresponding codes, as well as their HCFs' categories, are outlined in Table 4.2. This procedure is as agreed by the 81 participants and is compatible with the study's aims.

Table 4.2 Participants' Occupational Position, Code, and HCFs Category Code

HCF's category code	Participant's Code	Participant's position / job title	# of participants
C01	C01-P01	Director of eHealth Dept.	**3**
	C01-P02	HIT manager	
	C01-P03	Chief Financial Officer	
C02	C02-P04	Chief Operating Officer	**5**
	C02-P05	Head of Quality Management Department	
	C02-P06	Chief Information Officer	
	C02-P07	Assistant Hospital Director for HIT Services	
	C02-P08	Manager of HIT Systems integration	
C03	C03-P09	HIT manager	**3**
	C03-P10	Director of ICT Department	
	C03-P11	Supervisor of HR Dept.	
C04	C04-P12	Director of ICT Department	**5**
	C04-P13	Deputy Director	
	C04-P14	Chief Operating Officer	
	C04-P15	Director of ICT Department	
	C04-P16	HIT manager	
C05	C05-P17	HIT manager	**5**
	C05-P18	HIT Deputy Director	
	C05-P19	Financial manager	
	C05-P20	ICT Systems Manager	
	C05-P21	IT Acting Director	
C06	C06-P22	Supervisor of HIT Team	**5**
	C06-P23	HIT manager	
	C06-P24	Director of HR Department	
	C06-P25	Financial manager	
	C06-P26	Director of ICT Department	
C07	C07-P27	Healthcare Policy Maker	**3**
	C07-P28	Head of Assessment & Planning Unit	
	C07-P29	Chief Medical Officer	
C08	C08-P30	HIT manager	**3**
	C08-P31	Chief Executive Officer	
	C08-P32	Health Informatics Acting Director	
C09	C09-P33	Director of ICT Department	**3**
	C09-P34	Director of ICT Department	
	C09-P35	HIT manager	
C10	C10-P36	HIT manager	**3**
	C10-P37	Business Product Manager	
	C10-P38	Chief Information Officer	
C11	C11-P39	HIT manager	**3**
	C11-P40	Director of ICT Department	
	C11-P41	Supervisor of HIT Team	
C12	C12-P42	Chief Information Officer	**3**
	C12-P43	HIT Consultant	
	C12-P44	IT Acting Director	
C13	C13-P45	Chief Executive Officer	**3**

HCF's category code	Participant's Code	Participant's position / job title	# of participants
	C13-P46	HIT manager	
	C13-P47	Financial manager	
	C14-P48	Director of ICT Department	
C14	C14-P49	Supervisor of HIT Team	**3**
	C14-P50	Clinical Officer	
	C15-P51	Financial Officer	
C15	C15-P52	HIT manager	**3**
	C15-P53	HIT manager	
	C16-P54	HIT manager	
C16	C16-P55	Director of ICT Department	**3**
	C16-P56	HIT manager	
	C17-P57	Chief Operating Officer	
	C17-P58	HIT Consultant	
C17	C17-P59	Head of Assessment & Planning Unit	**5**
	C17-P60	Manager of HIT Systems integration	
	C17-P61	HIT manager	
	C18-P62	Director of ICT Department	
	C18-P63	Financial Officer	
C18	C18-P64	HIT Manager	**5**
	C18-P65	Clinical Officer	
	C18-P66	Financial Officer	
	C19-P67	HIT Consultant	
	C19-P68	Health Informatics Acting Director	
C19	C19-P69	Chief Operating Officer	**6**
	C19-P70	HIT manager	
	C19-P71	Director of ICT Department	
	C19-P72	Financial Officer	
	C20-P73	Business Product Manager	
C20	C20-P74	HIT Manager	**3**
	C20-P75	Chief Executive Officer	
	C21-P76	HIT Manager	
C21	C21-P77	Clinical Officer	**3**
	C21-P78	Director of ICT Department	
	C22-P79	Director of ICT Department	
C22	C22-P80	Clinical Officer	**3**
	C22-P81	Healthcare Policy Maker	

4.2.2 Interviews' approach

As discussed in Chapter 1, the interviews were conducted in the form of semi-structured interviews with open-ended questions. This approach allows flexibility in asking additional spontaneous questions during the interview. It also requires predetermined questions to be asked, for directing the discussions and ensuring that all specific topics are covered and that the required information has been extracted from the participants during the interview (Patton, 2015; DiCicco & Crabtree, 2006). Therefore, the final outcome of the First Phase (i.e., the initial version of JoinSTNassistant Framework) has been used as a basis for designing the semi-structured interviews and developing in advance the initial questions.

The initial set of interview questions was then reviewed by the Faculty Research Ethics Committee at Staffordshire University and by the Regional Research Ethics Committee at MOH (as shown in Appendices A and B), to ensure that it is purposive, succinct, unambiguous, and that it covered appropriately all the intended and specific topics in a neutral and unbiased way, whilst also ensuring its compatibility with the Code of Ethics and Standards of the MOH and Staffordshire University. Consequently, modifications were made to form the final approved set of the interviews' questions.

In order to cover sufficiently the large number of intended specific topics, and their corresponding initial questions, the interviews were designed to be conducted through seven-consecutive sessions, as shown in Figure 4.1.

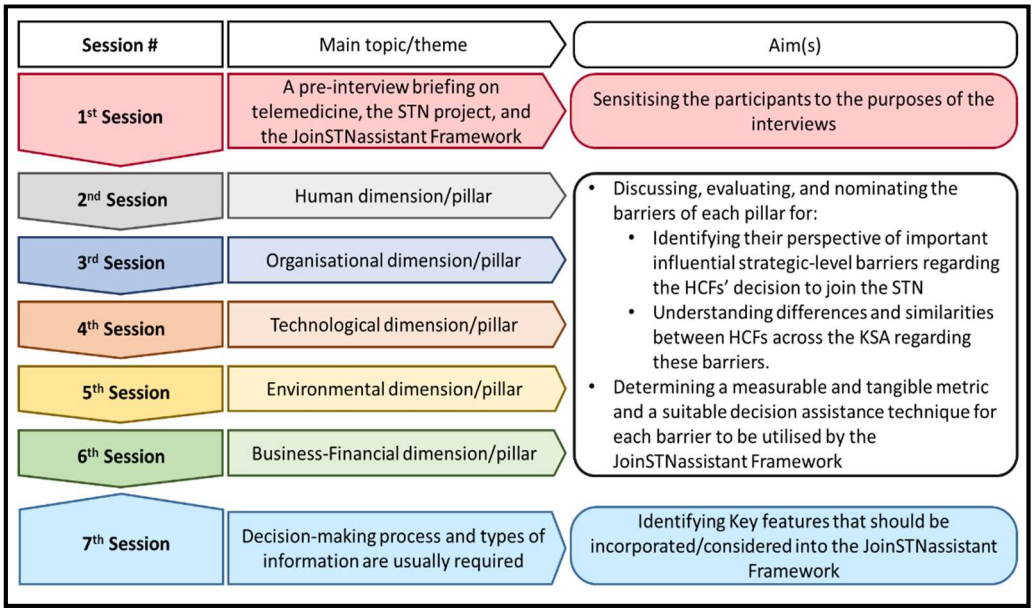

Figure 4.1 The Main Topic/Theme and Aim(s) of the Seven-Consecutive Interview Sessions

- ***The 1st interview session***

The main topic/theme of the first interview session was 'a pre-interview briefing on telemedicine, the STN project, and the JoinSTNassistant Framework'. This session was a knowledge dissemination (i.e., awareness) session, and aimed at informing the participants about telemedicine, the STN project, its challenges, the JoinSTNassistant Framework, and the aims of this study 's interviews. Therefore, a presentation and leaflets were provided to the participants in this session, which contained information about the following four subjects:

i. The main concepts of telemedicine and facts regarding its future,
ii. A summary of the STN project, its roadmap, and the challenges and barriers to its implementation,

iii. A summary of the JoinSTNassistant Framework (this research), the findings of the First Phase,
iv. the aims of the interviews, and the guidelines for the interviews' questions.

- ***The 2nd, 3rd, 4th, 5th, and 6th interview sessions***

The main topic/theme of each interview session of these five of the seven-consecutive interview sessions (from the 2nd to the 6th) was based around one of the five pillars of the initial version of the JoinSTNassistant Framework (i.e., human, organisational, technological, environmental, business-financial). Each of these interview sessions aimed at the following:

i. Discussing, evaluating, and nominating the barriers of each related pillar with the participants in order to identify their perspectives, and to develop an understanding of the differences and similarities between them regarding these barriers.
ii. Determining a measurable and tangible parameter/metric for each barrier and a suitable decision assistance technique to be utilised by the JoinSTNassistant Framework.

Each one of these five of the seven-consecutive interview sessions was comprised of the following questions:

- Do you expect this barrier could potentially influence your HCF's decision to join the STN?
- How do you think this barrier could be measured? And what is its tangible metric?
- Are there any other important barriers within this dimension/pillar that have NOT been identified?
- Can you share anything else that could be important and that we have not discussed?

- ***The 7th interview session***

The main topic/theme of the seventh interview session was the 'Decision-making process and the types of information usually required'. Therefore, it was aimed at understanding the normal decision-making process of the HCFs and the types of information that are usually required in order to implement a new ICT innovation.

Furthermore, it aimed at reaching a consensus on determining key features that should be incorporated/considered into the JoinSTNassistant Framework.

The seventh interview session was comprised of the following questions:

- What is the normal decision-making process of the HCF in order to decide to implement a new ICT system?
- What do you think about the decision-making process of the HCF in order to decide to join the STN?
- What do you think about key features that should be incorporated/considered into the JoinSTNassistant Framework for facilitating, enhancing, and assisting the HCF's decision to join the STN, to increase productivity and effectiveness? And what types of information are required/needed?
- What do you think about a suitable decision assist technique(s) to be utilised by the JoinSTNassistant Framework for facilitating, enhancing and assisting the HCFs decision to join the STN productively and effectively? And what kinds of reports are required/needed?

In addition, based on the participants' responses, additional appropriate questions were also asked within all seven-consecutive interview sessions, to gain in-depth understanding and cover the specific topics, or to permit other important aspects to emerge from the participants.

The seven-consecutive interview sessions were conducted via a videoconferencing system (WebEx) because the participants represent all 22-diverse categories of HCFs across the KSA, which are scattered all over the large geographical area of the KSA, with vast distances between them. Furthermore, the participants are usually busy and it is hard and costly to find adequate time and physical places for the interviews.

The duration of each interview session was scheduled to be four hours, on Saturdays (a weekend day), and to be conducted in English and Arabic languages.

During each interview session, notes were taken, and then, these were carefully transcribed, cleaned, and checked. Also, second coding was undertaken to compensate for the lack of quotations and maintain anonymity of the participants which was a

requirement of the ethical approval of the MOH. Afterward, they were emailed to the participants for approval.

In the interview sessions, the moderator (i.e., the researcher) was attempting to be unbiased about the discussed topics, and to encourage conflicting, non-normative and contentious views to be raised, as advocated by Rubin (2011).

4.2.3 Data analysis method

Polonsky and Waller (2014) as well as Mai et al. (2016) have asserted that the way that a given study reports and presents its findings must be aligned with the data analysis method that was used to detect these findings. Therefore, the 'reverse thinking' about these two elements is the best way of identifying a suitable data analysis method. This process firstly starts thinking about how the finding(s) of the study should be reported and presented, so as to reflect the aim of the study. Then, it seeks an appropriate data analysis technique to achieve the required way for reporting and presenting the findings (Mai et al., 2016; Polonsky & Waller, 2014).

In order to reflect the aims of this study, the findings should be reported and presented in a manner that interprets the perspectives of each of the 22-various HCFs categories regarding the diverse intended specific topics of this study. It is important to detect the crucial differences and similarities between these perspectives. Consequently, the cross-case qualitative comparative analysis was considered and chosen as the suitable data analysis technique to achieve the required method of reporting and presenting the findings.

The cross-case qualitative comparative analysis technique is the systematic and comprehensive qualitative way of conducting cross-case analysis and comparison of diverse symmetrical data sets, obtained from a variety of clusters or groups (Rihoux & Lobe, 2009; Eisenhardt, 1989; Miles & Huberman, 1994).

In order to apply it, the 22-diverse data sets (i.e., interview's transcripts) obtained from the 22-diverse HCFs categories should become 22-diverse symmetrical data sets. Therefore, rather than considering individually the single perspective of each participant within each 22-diverse HCFs category, the analysis focused on the conclusive and collective perspective, which emerges from (or is constructed within) this data set as a whole. This enables the entire perspective of each 22-diverse HCFs

category to be demonstrated, and the 22-diverse data sets (i.e., interview transcripts) to become 22-diverse symmetrical data sets (Rihoux & Lobe, 2009; Smithson, 2000).

4.3 Findings of the Analysis and Discussion

As mentioned in Section 4.1, this Second Phase of the development of JoinSTNassistant Framework is aimed at identifying the following:

i. The perspective of each of the 22-various HCFs' categories, as well as the crucial differences and similarities between these perspectives, pertaining to the 5 pillars and their 17-relevant barriers of the initial version of the JoinSTNassistant Framework.

ii. A suitable decision assist technique(s), key features, and a measurable and tangible parameter/metric for each of the 17-relevant barriers, to be utilised by or incorporated into the JoinSTNassistant Framework.

The analysis findings for the first point (i) are discussed and highlighted in this section, whereas the second point (ii) are discussed and presented in Chapter 6.

The analysis findings of the perspectives of the 22-various HCFs' categories pertaining to the Initial Version of the JoinSTNassistant Framework are illustrated in Table 4.3. This table lists the HCF's categories and the 17 barriers of the initial version of the JoinSTNassistant Framework by using respectively the codes described in Table 4.1 and in Chapter 3 (Table 3.4).

Table 4.3 shows that the 17 barriers of the initial version of the JoinSTNassistant Framework are expected by all the 22-diverse HCFs' categories to be significantly important influential strategic-level barriers with respect to their HCFs' decision to join the STN. However, the table shows that only 10, out of the 17 barriers, are expected by all the 22-diverse HCFs' categories to be significantly important influential strategic-level barriers with respect to their HCFs' decision to join the STN, as shown in Figure 4.2. These 10 common expected barriers are Hu2, Te1, Te2, Or1, Or2, Or3, Or4, En2, En5, and BF1.

Table 4.3 HCFs' Category Against its Perspective Regarding 17 Barriers of Initial Version of JoinSTNassistant Framework.

HCF's category code	Code of the discussed barrier																	Total # and (%) of expected barriers (out of 17)
	Hu1	Hu2	Or1	Or2	Or3	Or4	Te1	Te2	Te3	Te4	En1	En2	En3	En4	En5	BF1	BF2	
C01	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	14 (82.4%)
C02	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	15 (88.2%)
C03	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	16 (94.1%)
C04	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓		13 (76.5%)
C05	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓		13 (76.5%)
C06	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓		14 (82.4%)
C07	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		14 (82.4%)
C08	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		13 (76.5%)
C09	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓		12 (70.6%)
C10		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		12 (70.6%)
C11		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓		12 (70.6%)
C12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	16 (94.1%)
C13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	16 (94.1%)
C14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		15 (88.2%)
C15		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		13 (76.5%)
C16		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		13 (76.5%)
C17	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	16 (94.1%)
C18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	**17 (100%)**
C19	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	16 (94.1%)
C20	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	15 (88.2%)
C21	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	**17 (100%)**
C22	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	16 (94.1%)
Total # and (%) of HCF's categories expecting the barrier as significant (out of 22)	18 (81.9%)	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	13 (59.1%)	13 (59.1%)	16 (72.7%)	**22 (100%)**	10 (45.5%)	17 (77.3%)	**22 (100%)**	**22 (100%)**	11 (50.0%)	

✓ = **The barrier is expected to be an important influential strategic-level barrier with respect to the HCFs' decision to join the STN.**

As shown in Figure 4.2, seven barriers of the initial version of the JoinSTNassistant Framework are not expected by all the 22-diverse HCFs' categories to be significant

influential strategic-level barriers with respect to their HCFs' decision to join the STN. These 7 barriers are Hu1, Te3, Te4, En1, En3, En4, and BF2.

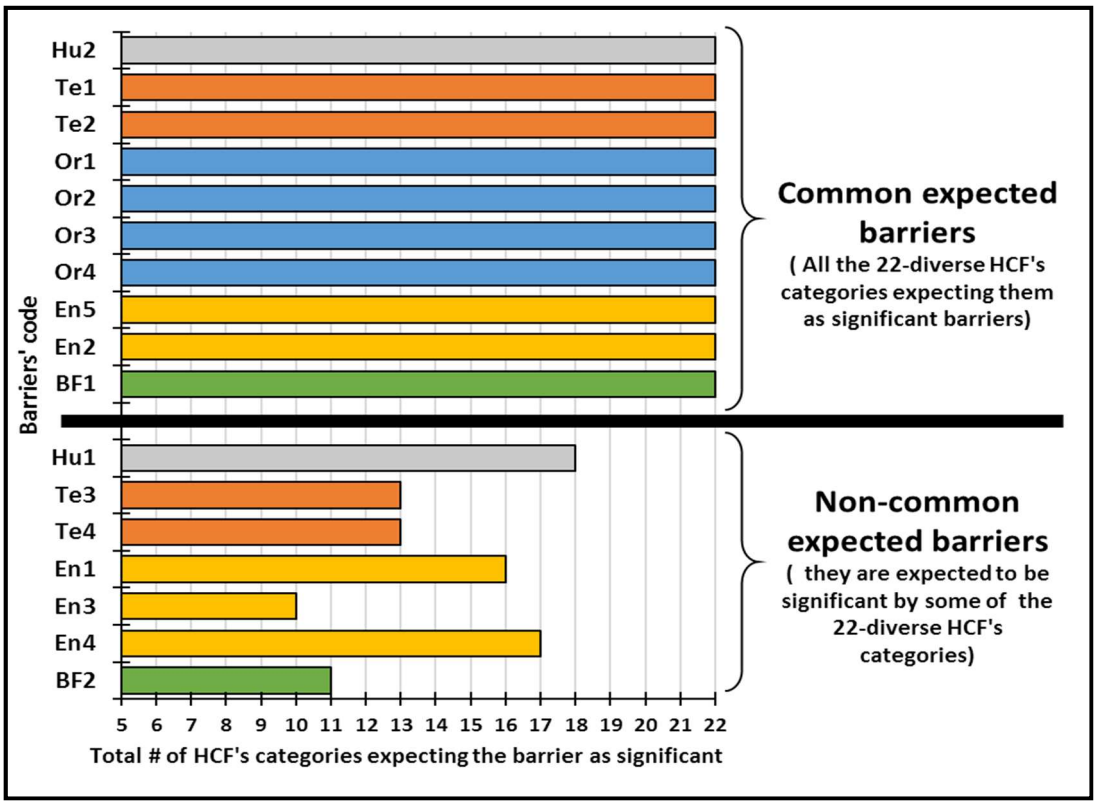

Figure 4.2 The Common Expected Barriers of the Initial Version of the JoinSTNassistant Framework

The following subsections discuss separately each of these 7 barriers, the collective perspective of the diverse HCFs' categories that do not expect it to be a significant barrier, and the possible explanations for their perspectives. In order to ensure confidentiality, quotes from interviewees/focus group participants will not be presented for ethical requirements as determined by the MOH. However, the collective perspective of the diverse HCFs' categories that do not expect it to be a significant barrier for each of these 7 barriers (out of a total 22 of barriers), which are presented as follows, emerges from (or is constructed within) interview's transcripts obtained from the 22-diverse HCFs categories as an entirety. Also, the possible explanations for their perspectives are the author's own reflection based on the interview's transcripts obtained from the 22-diverse HCFs categories.

- ***Hu1: Human acceptance***

  The Hu1 barrier refers to the acceptance of all types of involved humans who are necessary for implementing, using, operating, or benefiting from telemedicine

systems that are provided by the STN (e.g., the clinical staff in the HCFs and the citizens/patients, the ICT staff, etc.).

The findings of interviews, as shown in Table 4.3, show that 4 (18.2%) out of the 22- diverse HCFs' categories do not expect Hu1 barrier to be a significant influential strategic-level barrier with respect to their HCFs' decision to join the STN.

The collective perspective of these 4-diverse HCFs' categories is that human resistance is 'the inherent and permanent result' of implementing and utilising a new ICT innovation. They argued that it is no surprise that the decision to implement any new ICT innovation is often greeted with resistance and cynicism by the users (employees). Humans naturally cling to what they know and often resist any new changes to their practices' routine. Thus, if Hu1 is considered a significant barrier, it means that no new ICT innovation will be decided to be implemented.

One of the possible explanations for their collective perspective is that these 4-diverse HCFs' categories represent HCFs located within rural/remote areas of the KSA, which suffer severely from lack of clinical staff. Therefore, the decision to join the STN and utilise telemedicine within their HCFs is an immediate decision. Therefore, it should be taken without paying attention to the opinions of the clinical staff, employees, and patients.

In addition, these 4-diverse HCFs' categories represent the HCFs of military or other governmental sectors. Folkestad (2008) argued that the background/ideology of the organisation that a participant is representing, influences their opinion. In military organisations, the decision-making process is usually in the form of an autocratic style. The decision makers in military organisations take control of the decision and the employees' acceptance of the decisions is not considered.

- ***Te3: STN system's complexity***

  The Te3 barrier refers to the degree by which the STN systems are perceived by the KSA's HCFs as difficult to implement, operate, and/or maintain. The findings of the interviews, as shown in Table 4.3, show that 9 (40.9 %) out of the 22-diverse HCFs' categories do not expect this barrier to be a significant influential strategic-level barrier with respect to their HCFs' decision to join the STN.

The collective perspective of these 9-diverse HCFs' categories is that any new complex ICT innovation (e.g., telemedicine) is perceived as difficult to be implement, operate, and/or maintain at the beginning or at the early stages of its use, operation and maintenance. However, after training and practice of this new complex ICT innovation, experience is acquired that facilitates its use, operation and maintenance. The Te3 is not considered a barrier, rather it is 'human normalcy syndrome' of any new complex ICT innovation.

One of the possible explanations for their collective perspective is that all of these 9-diverse HCFs' categories represent the two biggest HCF's types within the KSA (medical city and hospital), which usually have expert staff who are highly trained in operating, using, and maintaining such complex systems.

- ***Te4: Interoperability***

  The Te4 barrier refers to the extent to which the STN systems are interoperable with the existing ICT systems and devices of the HCFs. The findings of interviews, as shown in Table 4.3, show that 9 (40.9 %) out of the 22-diverse HCFs' categories do not expect this barrier to be a significant influential strategic-level barrier with respect to their HCFs' decision to join the STN.

  The collective perspective of these 9-diverse HCFs' categories is that the STN's system and the needs for its services are more important than thinking about its interoperability with the existing ICT systems and devices of the HCFs. Therefore, any existing ICT system that is not interoperable with the STN's system will be changed.

  One of the possible explanations for the collective perspective of these 9-diverse HCFs' categories is that all of them represent either the smallest HCF's type within the KSA (PHCs) or hospitals within the rural areas of the KSA, which usually have none or a few, existing ICT systems and devices within the HCFs. Therefore, they ignore the Te4 barrier and are willing to change their few existing ICT systems and devices because it will not be costly.

- ***En1: National cultural restrictions***

  The En3 barrier refers to the underlying beliefs, values and norms of the KSA's society. The findings of interviews, as shown in Table 4.3, show that 6 out of 22 (27.3%) of HCFs' categories do not expect this barrier to be a significant

influential strategic-level barrier with respect to their HCFs' decision to join the STN.

The collective perspective of these 6-diverse HCFs' categories is that, in the healthcare context, providing healthcare services, especially critical and urgent healthcare services such as emergency treatments, particularly for the people from deprived areas, via any tools or systems, is more important than the national culture (i.e., beliefs, norms, religion). Furthermore, delivering healthcare services is not always in harmony with some aspects of the national culture (i.e., beliefs, norms, religion). In addition, the cultural and traditional beliefs of human being are changeable and what is prohibited now might be permitted later. For instance, the cultural and traditional beliefs of some Saudi citizens in the past prohibited watching the TV or using the cameras, and now they have become 'addicted to' watching TV and using smartphones with cameras.

One of the possible explanations for the perspectives of these 6-diverse HCFs' categories is that the majority of them represent the HCFs located within rural areas of the KSA, which suffer severely from the lack of healthcare services.

- ***En3: Characteristics of KSA healthcare system***

  The En3 barrier refers to the intense competition among the HCFs within the KSA healthcare system as well as the external pressures (e.g., from the MOH, the STN agency, vendors, etc.). The findings of the interviews, as shown in Table 4.3, show that 12 (54.5%) out of the 22- diverse HCFs' categories do not expect this barrier to be a significant influential strategic-level barrier with respect to their HCFs' decision to join the STN.

  The possible explanation for the perspectives of those 12-diverse HCFs' categories is that all of them represent HCFs of governmental sectors (non-profit governmental HCFs). They provide healthcare services and treatments free of costs. Therefore, there is no intense competition among them.

- ***En4: National ICT infrastructure and basic facilities of the KSA***

  The En4 barrier refers to the level of support and quality of national ICT infrastructure and basic facilities of KSA in the HCFs' surrounding area. The findings of interviews, as shown in Table 4.3, show that 12 out of 22 (54.5%) of HCFs' categories do not expect this barrier to be an important influential strategic-level barrier with respect to their HCFs' decision to join the STN.

The possible explanations for the perspectives of these 12-diverse HCFs' categories are that all of them represent the HCFs of the military sector. They are regularly supported by the government, which usually provides them with the necessary basic facilities and ICT infrastructure.

- ***BF2: The economic feasibility and justifiability of join the STN***

  As shown in Table 4.3, the findings of interviews show that 11 (50.0%) out of the 22-diverse HCFs' categories do not expect the BF2 barrier to be a significant influential strategic-level barrier with respect to their HCFs' decision to join the STN.

  The possible explanation for the perspectives of those 11-diverse HCFs' categories is that all of them represent HCFs of governmental sectors (non-profit governmental HCFs). They provide healthcare services and treatments free of costs. Therefore, they are not seeking economic benefits for their HCFs.

There are no additional influential strategic level barriers to add to the initial version of the JoinSTNassistant framework. In addition, the final outcome demonstrates that there is no consensus of perspective among all the 22-diverse HCFs' categories of the KSA, regarding the same set of significant influential strategic-level barriers, with respect to their HCFs' decision to join the STN. Only 2-diverse HCFs' categories (C21, C18) out of the 22, expect all the 17 barriers to be significant barriers. Whereas, each one of the other 20-diverse HCFs' categories expects a different subset of the 17 barriers to be significant barriers. The results in each one of the other 20-diverse HCFs' categories has its own unique subset of the 17 barriers of the initial version of the JoinSTNassistant Framework.

These findings were expected and are compliant with the findings of prior studies, such as Cresswell & Sheikh (2013), Baker (2012), Healy (2008), Bouwman et al. (2005), and Gagnon et al. (2005). These studies have asserted that although most organisations are likely to face some common barriers in implementing a given ICT innovation, each organisation will have its own unique sets of barriers (Healy, 2008; Gagnon et al., 2005; Cresswell & Sheikh, 2013; Baker, 2012; Bouwman et al., 2005). These barriers emerge from the characteristics of many dimensions, such as its strategy, plan, services provided, location, business drivers etc.. In addition, some of the barriers that limited the implementation of one ICT innovation within a given

organisation, may no longer exist, be partly diminished, or become an opportunity for another organisation (Gilson & Raphaely, 2008; Baker, 2012).

The overall/comprehensive findings are in line with the findings of prior studies. As discussed previously in Chapter 3 and shown in Table 3.6, these 17 barriers have been identified and cited as an influential barrier to implement telemedicine within HCFs of many countries such as Kuwait (Buabbas, 2013), Iran (Keshvari et al., 2014), and Malaysia (Zailani et al., 2014). They have also hindered the implementation of many ICT projects within various organisations across the KSA. Those ICT projects such as (i) eGovernment (El-Sofany et al., 2012; Alshehri et al., 2012; Franke & Eckhardt, 2014), (ii) eLearning (Bingimlas, 2009), and (iii) eServices (Al-Mudimigh et al., 2011).

4.4 Findings' Implications

The final outcome of this interviews study (the Second Phase) has proved that it could not be a one-size-fits-all framework that could be applicable and used by all the 22-diverse HCFs for assisting their decision to join the STN in a scientific, effective, sensible, and realistic way. This outcome is compatible with the findings of other researchers who have argued that a given framework that leads to a successful implementation of one ICT innovation in a given country/organisation may not be suitable for the same ICT innovation within another country/organisation (Gilson & Raphaely, 2008; Cresswell & Sheikh, 2013; Yu, 2010; Westbrook et al., 2007).

Therefore, based on the findings of the Second Phase, the initial version of the JoinSTNassistant Framework was revised and developed into a technique that could be modified and adjusted to be applicable for all the 22-diverse categories of the HCFs within the KSA, as shown in Figure 4.3.

As shown in Figure 4.3, the 17 barriers of the developed version of the JoinSTNassistant Framework were classified into two sets based on the findings of the Second Phase. The first set consisted of the 10 common significant barriers; i.e., the 10 barriers that are commonly expected by all the 22-diverse HCFs' categories to be significantly important influential strategic-level barriers with respect to their HCFs' decision to join the STN. Whilst, the second set consisted of the 7 barriers which are not expected to be so by all 22-diverse HCFs' categories. Therefore, the developed version of the JoinSTNassistant Framework could be modified and adjusted to be

applicable for each HCFs' category of the 22-diverse categories of the HCFs within the KSA.

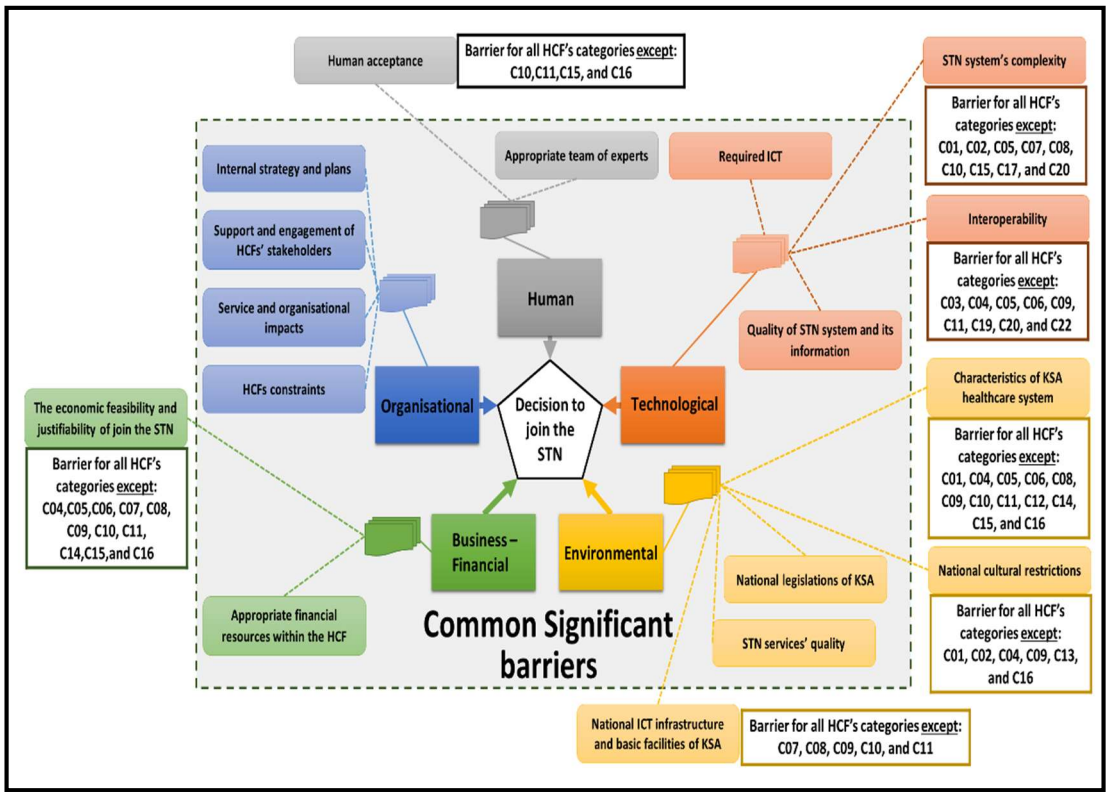

Figure 4.3 The Developed Version of the JoinSTNassistant Framework

For instance, as shown in Figure 4.4 and Figure 4.5, the JoinSTNassistant Framework is modified and adjusted to be applicable for HCFs of C22 Category and C10 Category, respectively, based on the findings of the perspectives of their participants.

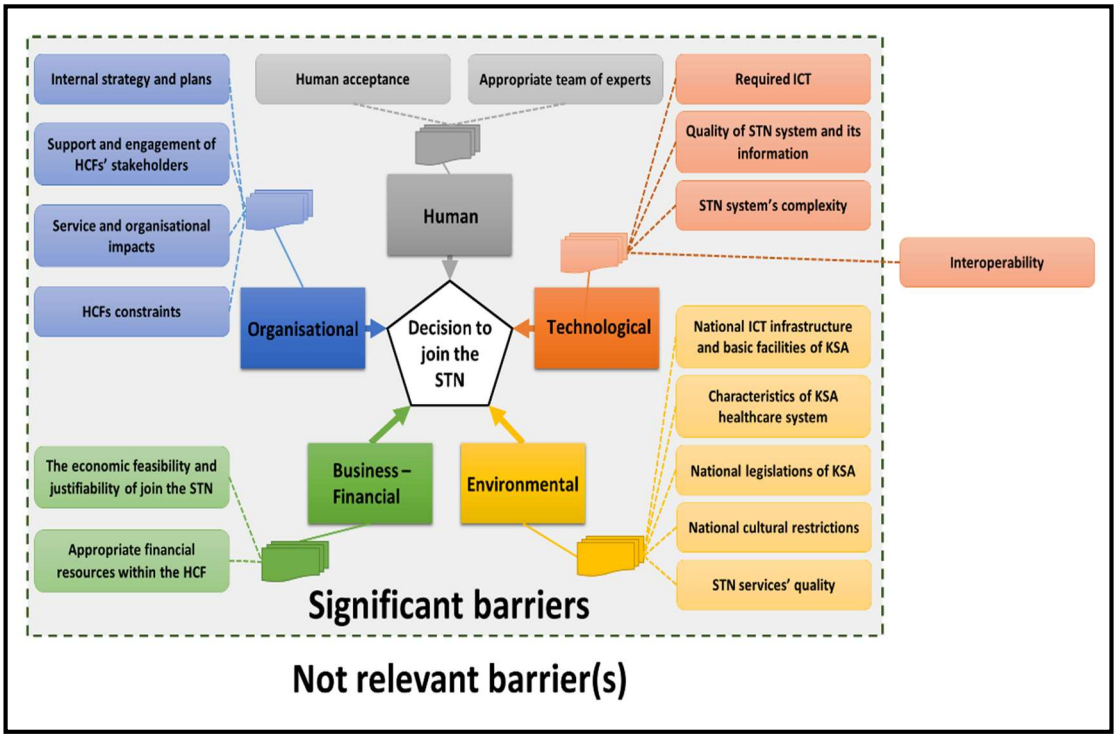

Figure 4.4 Developed Version of the JoinSTNassistant Framework for HCFs of C22 Category

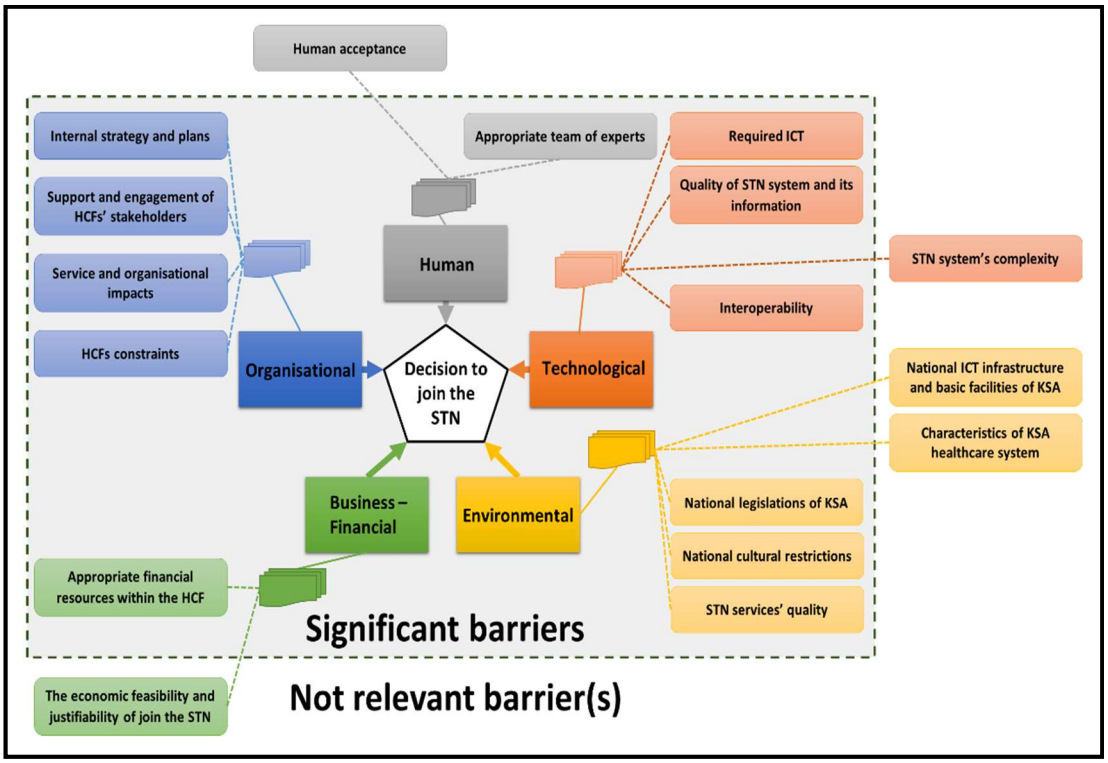

Figure 4.5 Developed Version of the JoinSTNassistant Framework for HCFs of C10 Category

Figure 4.6 shows the initial version from the First Phase and the developed version of the JoinSTNassistant Framework.

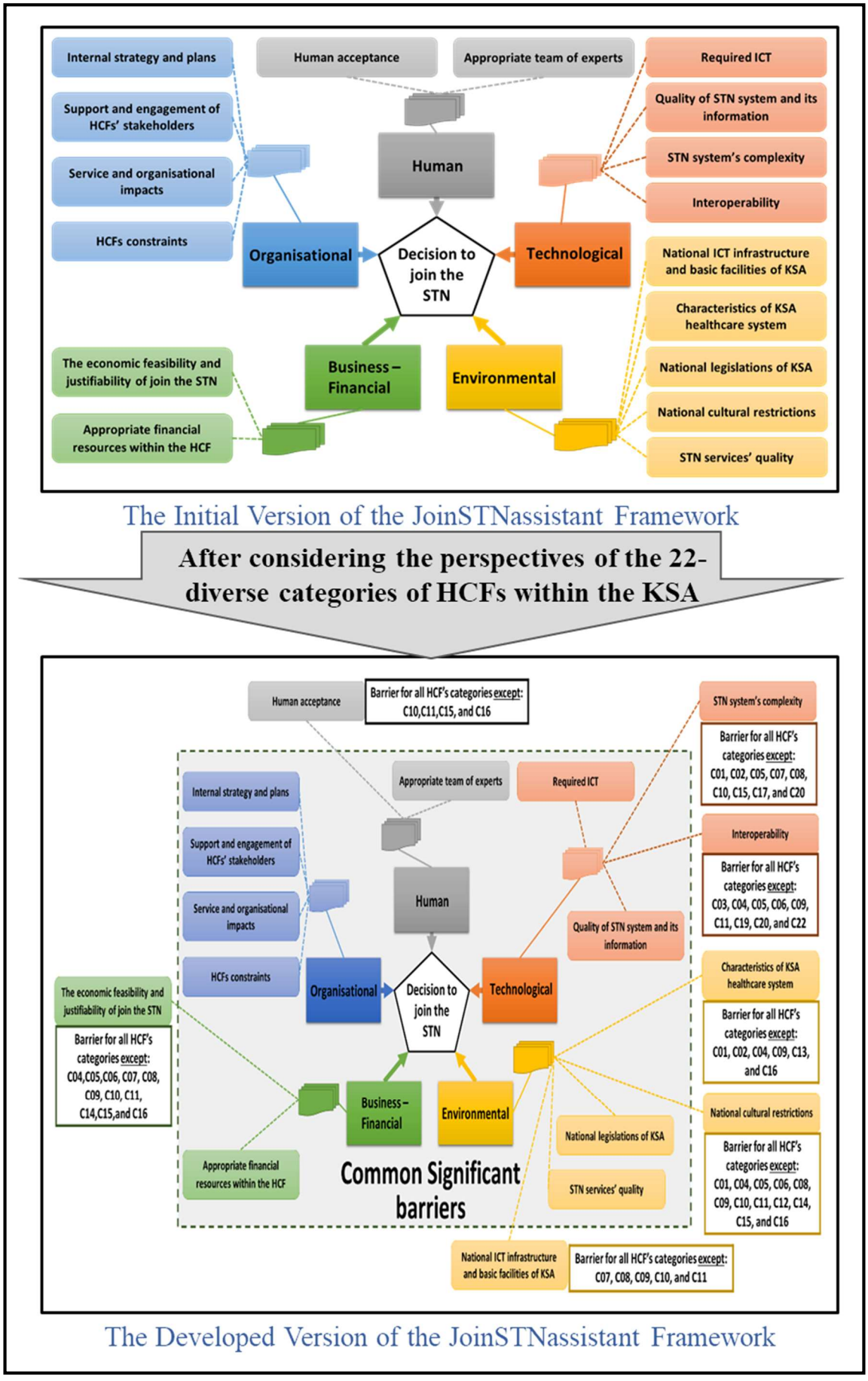

Figure 4.6 The Initial Version Against the Developed Version of the JoinSTNassistant Framework

4.5 Conclusions

Many seemingly attractive and theoretically sound new frameworks have failed to achieve their goals and disappeared without trace because they were not applicable for the context and the needs of the systems or the people for whom they had been developed. In other words, they had been developed without gaining the understanding of the people for whom they had been developed.

The Second Phase of the JoinSTNassistant Framework, presented in this Chapter 4, has addressed this issue as it has consulted with its potential users (i.e., strategic-level decision makers of the HCFs within the KSA) and has revised the version produced by the first phase accordingly. The Second Phase was planned and implemented for consulting and involving the potential users, and derive a revised version of the First Phase that incorporated their perspectives.

This was achieved by carefully planned but open-ended interviews, conducted with 81 strategic-level expert members of the STN-Communities of Practice (STN-CoP), representing all the 22-diverse categories of HCFs within the KSA.

The final outcome demonstrated that there is no consensus among all the 22-diverse HCFs' categories, regarding the significant influential strategic-level barriers to their decision to join the STN. Almost each one of them has its own unique subset of the 17 barriers of the initial version of the JoinSTNassistant Framework. Thus, this Framework could not and should not be a one-size-fits-all framework, applicable and used by all the 22-diverse HCFs within the KSA for assisting their decision to join the STN.

Therefore, based on the findings of this Second Phase, the initial version of the JoinSTNassistant Framework was revised and developed into a technique that could enable it to be modified and adjusted to be applicable for all the 22-diverse categories of the HCFs within the KSA. This involved distinguishing between barriers common to all HCFs categories and barriers specific to HCFs categories, as shown in Figure 4.3.

The final outcome of this Second Phase, referred to as the developed version of the JoinSTNassistant Framework, was used in the next phase (i.e., the Third Phase) of the development of the JoinSTNassistant. The findings of this Second Phase were used in the Third Phase, to develop a questionnaire aimed at validating the findings by a representative sample size of the decision makers of HCFs across the KSA. Further details about the third phase are provided and discussed in Chapter 5.

Chapter 5: Third Phase of Development of the JoinSTNassistant Framework

5.1 Introduction

Chapter 4 described and discussed the Second Phase, which deals with the practical and pragmatic requirements of the JoinSTNassistant Framework, and was planned and implemented for consulting and involving its potential users. This was done by conducting interviews with 81 strategic-level expert members of the STN-Communities of Practice (STN-CoP), representing all the 22-diverse categories of HCFs within the KSA. The final outcome of the Second Phase is referred to as the "Developed Version of the JoinSTNassistant Framework".

This chapter describes and discusses the Third Phase, which consists of a questionnaire based survey, conducted in the KSA. This questionnaire was based on the findings of the Second Phase (i.e., the Developed Version of the JoinSTNassistant Framework) and aimed at validating them by a representative sample size of the decision makers of HCFs across the KSA. Therefore, the findings of this Third Phase will be a part of the data triangulation that will enhance and increase the reliability and validity of the research (i.e., the JoinSTNassistant Framework), and will give higher credibility for its findings and highlight any deficiencies.

The final outcome of the Third Phase provides a new revised version of the JoinSTNassistant Framework, referred to as the "Final Version of JoinSTNassistant Framework", which was developed based on the findings of the questionnaire. The following sections of this chapter present and discuss the Third Phase and its findings. Section 5.2 highlights the development of the questionnaire. This explains the development and the pre-test of the questionnaire instrument, as well as the ethical statement, the settings and the administration of this questionnaire based phase. Section 5.3 presents the data analysis method, while Section 5.4 discusses the implications of the findings.

5.2 Description of the Questionnaire

5.2.1 Development of the questionnaire instrument

The design of the questionnaire instrument is a most important aspect of the research, as it is necessary for achieving the aims of the study. Three important aspects have been

considered in order to develop an appropriate questionnaire instrument for data collection, which are:

i. The type of information that needs to be collected from the respondents;

ii. The appropriate respondents from whom to extract that required information;

iii. The useful and appropriate questions and approaches to extract that information (Goodman, 1997; Patten, 2016).

Therefore, the questionnaire was developed from a pool of survey instruments that were generated based on the findings of the Second Phase (i.e., the Developed Version of the JoinSTNassistant Framework). Its questions were aimed at identifying the perspective of the respondents, regarding the important, influential strategic-level barriers, determined in the Second Phase, with respect to their decision to join the STN. Furthermore, the questionnaire was designed to be distributed to and responded by the decision makers of HCFs across the KSA who have knowledge and experience about telemedicine and its implementation.

Therefore, the questionnaire, as shown in Appendix C, contained six main parts, as follows:

i. The first part provided a brief about the aims and objectives of this research, making clear the intention to measure the respondents' perspective of the questions presented, and ensuring complete confidentiality. Furthermore, the Questionnaire's code number (201504-0003), which is generated by the MOH, as well as the names of the researchers, their affiliations, and their contact information were also provided in this part.

ii. The second part included abbreviations' meanings and a glossary for all unfamiliar terms within the questionnaire.

iii. The third part asked the respondents about their role (i.e., position /job title) within the HCFs. This data was required to allow us to determine whether the respondents belong to the strategic level (i.e., working at the top echelons of HCFs) and can influence or participate in the decision-making process of his/her HCF regarding the decision of

joining the STN). Therefore, returned questionnaires from any respondents who did not belong to the strategic level were excluded in this study. Furthermore, the respondents were asked if they had ever heard of telemedicine before, or if they had ever participated in any telemedicine project. When their answers were **No**, their returned questionnaires were also excluded.

iv. The fourth part was designed to collect data about each respondent's HCF (its sector, type, and location). This data was required to allow us to categorise and sort the returned questionnaires, based on the 22-diverse categories of HCFs within the KSA, in order to identify the perspective of each of them and understand differences and similarities between the 22-diverse categories of HCFs regarding their perspectives.

v. The fifth part was designed to measure and assess the opinions and perspectives of the respondents about the important, influential strategic-level barriers with respect to their decision to join the STN, as determined in the Second Phase (i.e., the Developed Version of the JoinSTNassistant Framework). In this part, the participants were asked to answer the questions by indicating their opinions regarding the influence of each statement on a seven point Likert scale. This was done by ticking the appropriate box, where -3 = strongly no influence; -2= no influence; -1= somewhat no influence; 0= uncertain; 1= some influence; 2= influence; 3= strong influence. Each question in this part is linked to one of the important, influential strategic-level barriers with respect to their decision to join the STN (i.e., the findings of the Second Phase).

vi. Finally, in the sixth part, the respondents were given the opportunity to make any comments or suggestions.

5.2.2 The pre-test of the questionnaire instrument

The questionnaire was drafted using the focus group technique, utilising the authors' personal and professional experiences. Then, the questionnaire was reviewed by a number of academics and by the Researches and Studies General Department of the MOH. Consequently, modifications were made to form the final approved

questionnaire, which was further reviewed by the Researches and Studies General Department of the MOH. Afterward, a pilot study was conducted, where the initial draft of the questionnaire was distributed to and responded by 68 chosen at random decision makers of HCFs across the KSA. The pilot study was aimed at ensuring the understanding and applicability of each question. Notes from pilot respondents were taken and questions were accordingly amended. The pilot study has been tested in order to improve the content, accuracy, validity, and reliability of the adopted questions. The pilot test was conducted by identifying the values of factor loadings, Cronbach alpha, and Average Variance Extracted (AVE). The results of the pilot tests were fairly satisfactory, as manifested by good Cronbach's alpha values (all above 0.80 (George & Mallery, 2010)), acceptable factor loadings values (all above 0.66 (Nunnally, 1978)), and acceptable AVE values (all above 0.5 (Fornell & Larcker, 1981)) (More details about the results of the pilot tests of the questionnare are shown in Appendix D) . The overall analysis suggested that the questionnaire instrument was of adequate reliability and construct validity.

5.2.3 The ethical statement

This questionnaire was reviewed and approved by the Faculty Research Ethics Committee at Staffordshire University and by the Regional Research Ethics Committee at MOH (as shown in Appendices A and B), and it follows their code of practice. For instance, all respondents were informed about the purpose of the study and they gave their consent for participation. Respondents were:

i. Asked not to participate in this questionnaire if they are vulnerable to coercion or undue influence;
ii. Assured that all answers will be treated in confidence and that their names are not required;
iii. Assured that they could withdraw from the survey at any time without any consequences;
iv. Informed that their participation in this project is voluntary and that there are no direct personal benefits for participating in this research;
v. Assured that there are no risks associated with participation.

5.2.4 Settings and administration of the questionnaire

During the period from April 2015 to September 2015, the questionnaire was available in two different types of media: paper-based and web-based, as well as in Arabic and English languages. The invitations to participate in the questionnaire were sent by the authors, by the STN agency, and by the National eHealth Strategy and Change Management Office in the MOH, through emails, to all the decision makers of HCFs across the KSA. Social media (e.g., Tweeter, Facebook, etc.) and Instant Messages (IM) applications (e.g., WhatsApp) were also used to distribute the questionnaire. The questionnaire has the logo of Staffordshire University and the MOH, who share responsibility for the study, to make clear that this study is certified and credible by the MOH.

5.3 Data Analysis Method

As discussed in Chapter 1, a quantitative method was used in the data analysis of this questionnaire, since this Third Phase is aimed at gathering data in numerical and statistical form, which can be put into categories, or in rank order, or measured in units of measurement (Creswell, 2013), in order to identify the perspective of each of the 22-diverse categories of HCFs within the KSA.

The data analysis was completed using the IBM Statistical Package for the Social Science (SPSS) software (version 24). The Kruskal—Wallis *H* test (Kruskal & Wallis, 1952) were used to find the *P*-value, which determines if there are statistically significant differences between the perspectives of the 22-diverse categories of HCFs within the KSA regarding each barrier (if *P*-value < 0.05).

5.4 The Findings and Discussion

Among all returned questionnaires (2,076), 905 (43.6%) responses were selected and found to be complete and usable; while 743 returned questionnaires were not complete and 428 returned questionnaires were excluded because the respondents who had filled them out stated that either they did not belong to the strategic level, or they had not heard of telemedicine before, or they had not ever participated in any telemedicine project (unfamiliarity with telemedicine). The 905 selected responses have been approved to be representative, and constitute a sufficient sample size for the degree of accuracy/margin of error less than 5% (Barlett et al., 2001). Table 5.1 summarises the respondents' profiles and their HCFs category code, by using the codes described in Chapter 4 (Table 4.1).

Table 5.1 Descriptive Statistics of Respondents' Profiles

Measure	Item	Frequency	(%)	
The respondent's role (i.e., position /job title)	C-Level Executive.	36	4.0%	100%
	Director/vice president/manager.	558	61.7%	
	Director/Head of IT/ ICT.	173	19.1%	
	Healthcare Policy Makers and Regulators.	24	2.6%	
	Senior Manager.	82	9.1%	
	Administrator.	32	3.5%	
The respondent's HCFs category code	C01	11	1.2%	100%
	C02	205	22.7%	
	C03	14	1.5%	
	C04	144	15.9%	
	C05	32	3.5%	
	C06	95	10.5%	
	C07	3	0.4%	
	C08	18	2.0%	
	C09	13	1.4%	
	C10	13	1.4%	
	C11	10	1.1%	
	C12	10	1.1%	
	C13	26	2.9%	
	C14	27	3.0%	
	C15	13	1.4%	
	C16	18	2.0%	
	C17	90	9.9%	
	C18	15	1.7%	
	C19	92	10.2%	
	C20	16	1.8%	
	C21	13	1.4%	
	C22	27	3.0%	

Figure 5.1 shows the descriptive statistics of respondents based on their HCF's sector, type, and location.

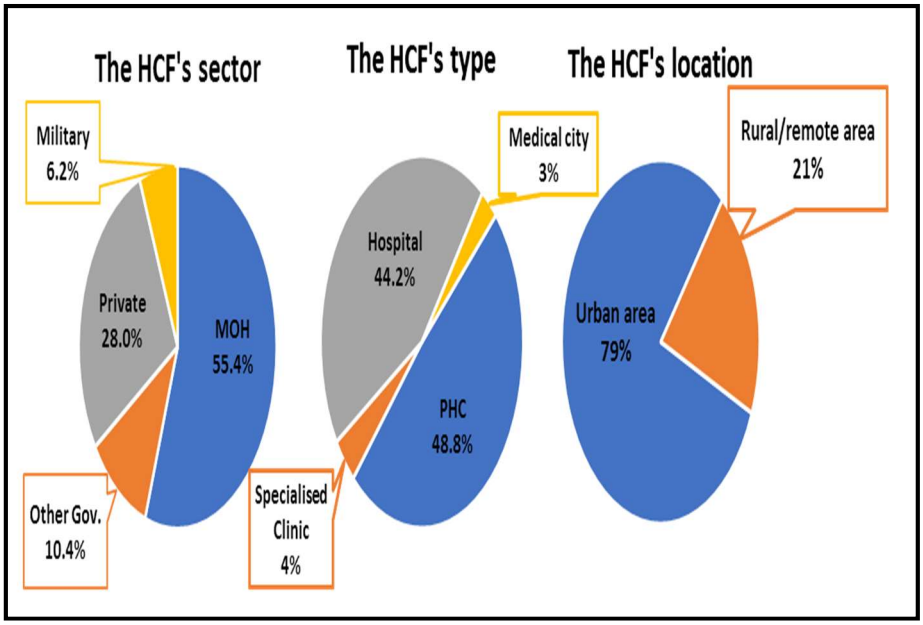

Figure 5.1 Descriptive Statistics of Respondents based on their HCF's Sector, Type, and Location

The analysis' findings of the perspectives of the 22-various HCFs' categories pertaining to the developed version of the JoinSTNassistant Framework are illustrated in Table 5.2. This table lists the HCF's categories and the 17 barriers of the JoinSTNassistant Framework by using, respectively, the codes described in Chapter 4 (Table 4.1) and in Chapter 3 (Table 3.4).

Table 5.2 shows that there are differences between the findings of the 2nd and the 3rd phases regarding the barriers expected by the 22-diverse HCFs' categories to be significantly important influential strategic-level barriers with respect to their HCFs' decision to join the STN. In other words, some barriers were expected by strategic-level members of the STN-Communities of Practice (STN-CoP) to be significantly important influential strategic-level barriers, but these barriers are not statistically significant to be so in the 3rd Phase, and vice versa.

For instance, Hu1 (i.e., human acceptance) barrier was expected in the 2nd Phase by the C01, C03, C06, C08, and C13 HCFs' categories to be an important influential strategic-level barrier, but is Not statistically significant to be so in the 3rd phase (i.e., by 50% or above of the respondents). Conversely, this barrier (Hu1) was not expected in the 2nd Phase by the C10 HCFs' category to be an important influential strategic-level barrier, but is statistically significant to be so in the 3rd Phase (i.e., by 50% or above of the respondents).

Table 5.2 further shows that for only two (C07 and C17) out of the 22-diverse HCFs' categories, their expected barriers in the Second Phase are the same as their statistical significant barriers in the Third Phase. The expected barriers of each one of the other 20-diverse HCFs' categories are different from the statistical significant barriers in the Third Phase.

For instance, in the 2nd Phase, strategic-level members of the STN-CoP who represent C19 and C20 HCFs' categories, expected respectively 15 and 16 barriers out of the 17 barriers to be important influential strategic-level barriers with respect to their decision to join the STN, whereas, in the 3rd Phase, the statistical analysis of the questionnaire indicates that all the 17 barriers of the JoinSTNassistant are statistically significant to be important influential strategic-level barriers for these two diverse HCFs' categories (C19 and C20). However, the findings of 3rd phase questionnaire show that each one of the other 20-diverse HCFs' categories has its own unique subset of the 17 barriers of the JoinSTNassistant Framework.

Table 5.2 HCFs' Category Against its Perspective Regarding 17 Barriers of Developed Version of JoinSTNassistant Framework.

HCF's category code	Code of the barrier																	Total # and (%) of expected barriers (out of 17)	
	Hu1	Hu2	Or1	Or2	Or3	Or4	Te1	Te2	Te3	Te4	En1	En2	En3	En4	En5	BF1	BF2	In the Second Phase	In the Third Phase
C01	-	✓	✓	✓	✓	✓	✓	✓		✓	+	✓	+	✓	✓	✓	✓	14 (82.4%)	15 (82.4%) ▲
C02	✓	✓	✓	✓	✓	✓	✓	✓	+	✓	+	✓	-	✓	✓	✓	✓	15 (88.2%)	16 (94.1%) ▲
C03	-	✓	✓	✓	✓	✓	✓	✓	-	+	✓	✓	-	✓	✓	✓	✓	16 (94.1%)	14 (82.4%) ▼
C04	✓	✓	✓	✓	✓	✓	✓	✓	✓		+	✓		✓	✓	✓	+	13 (76.5%)	15 (88.2%) ▲
C05	✓	✓	✓	✓	✓	✓	✓	✓	+		✓	✓		✓	✓	✓	+	13 (76.5%)	15 (88.2%) ▲
C06	-	✓	✓	✓	✓	✓	✓	✓	-		✓	✓		✓	✓	✓		14 (82.4%)	12 (70.6%) ▼
C07	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		14 (82.4%)	14 (82.4%)
C08	-	✓	✓	✓	✓	✓	✓	✓	+	✓	✓	✓		+	✓	✓	+	13 (76.5%)	15 (88.2%) ▲
C09	✓	✓	✓	✓	✓	✓	✓	✓	-		+	✓	+		✓	✓		12 (70.6%)	13 (76.5%) ▲
C10	+	✓	✓	✓	✓	✓	✓	✓	+	✓	✓	✓			✓	✓	+	12 (70.6%)	15 (88.2%) ▲
C11		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	+	+	✓	✓		12 (70.6%)	14 (82.4%) ▲
C12	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓		✓	✓	✓	✓	16 (94.1%)	15 (88.2%) ▼
C13	-	✓	✓	✓	✓	✓	✓	✓	✓	-	+	✓	✓	✓	✓	✓	✓	16 (94.1%)	15 (88.2%) ▼
C14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	+	15 (88.2%)	16 (94.1%) ▲
C15		✓	✓	✓	✓	✓	✓	✓	+	✓	✓	✓		-	✓	✓		13 (76.5%)	13 (76.5%) ▲
C16		✓	✓	✓	✓	✓	✓	✓	✓	✓	+	✓	+	✓	✓	✓	+	13 (76.5%)	16 (94.1%) ▲
C17	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	16 (94.1%)	16 (94.1%)
C18	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	17 (100%)	15 (88.2%) ▼
C19	✓	✓	✓	✓	✓	✓	✓	✓	✓	+	✓	✓	✓	✓	✓	✓	✓	16 (94.1%)	**17 (100%)** ▲
C20	✓	✓	✓	✓	✓	✓	✓	✓	+	+	✓	✓	✓	✓	✓	✓	✓	15 (88.2%)	**17 (100%)** ▲
C21	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓	✓	✓	✓	17 (100%)	15 (88.2%) ▼
C22	✓	✓	✓	✓	✓	✓	✓	✓	✓	+	✓	✓	-	✓	✓	✓	-	16 (94.1%)	15 (88.2%) ▼
Total # and (%) of HCF's categories expecting the barrier as significant (out of 22) — **In the Second Phase**	18 (81.9%)	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	13 (59.1%)	13 (59.1%)	16 (72.7%)	**22 (100%)**	10 (45.5%)	17 (77.3%)	**22 (100%)**	**22 (100%)**	11 (50.0%)		
Total # and (%) of HCF's categories expecting the barrier as significant (out of 22) — **In the Third Phase**	14 (63.6%) ▼	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%)**	**22 (100%**	**22 (100%)**	14 (63.6%) ▲	15 (68.2%) ▲	**22 (100%)** ▲	**22 (100%)**	9(40.9%) ▼	18(81.8%) ▲	**22 (100%)**	**22 (100%)**	16 (72.7%) ▲		

✓ = **The barrier is expected <u>in both</u> (the 2nd and 3rd) phases to be an important influential strategic-level barrier with respect to the HCFs' decision to join the STN.**

- = **The barrier was an expected important influential strategic-level barrier with respect to the HCFs' decision to join the STN in the 2nd Phase, <u>BUT is Not</u> so in the 3rd Phase (i.e., by 50% or above of the respondents).**

+ = **The barrier was <u>NOT</u> an expected important influential strategic-level barrier with respect to the HCFs' decision to join the STN in the 2nd phase, <u>BUT is</u> so in the 3rd Phase (i.e., by 50% or above of the respondents).**

▲ = **Either the total # of the HCF's categories expecting the barrier as significant or the total # of the expected barriers for the HCF's category has increased in the 3rd Phase.**

▼ = **Either the total # of the HCF's categories expecting the barrier as significant or the total # of the expected barriers for the HCF's category has decreased in the 3rd Phase.**

Furthermore, as shown in Figure 5.2, while only 10, out of the 17 barriers, are expected by all the 22-diverse HCFs' categories to be significantly important influential strategic-level barriers in the 2nd Phase, the findings of the 3rd Phase questionnaire indicate that the En1 barrier is also statistically significant to be an important influential strategic-level barrier for all the 22-diverse HCFs' categories. Therefore, as shown in Table 5.2 and Figure 5.2, in the 3rd Phase, 11 out of the 17 barriers are statistically significant to be important influential strategic-level barriers for all the 22-diverse HCFs' categories with respect to their decision to join the STN. These 11 common barriers include all the 10 common barriers identified in the Second Phase (Hu2, Te1, Te2, Or1, Or2, Or3, Or4, En2, En5, and BF1) but also the En1, as shown in Figure 5.2.

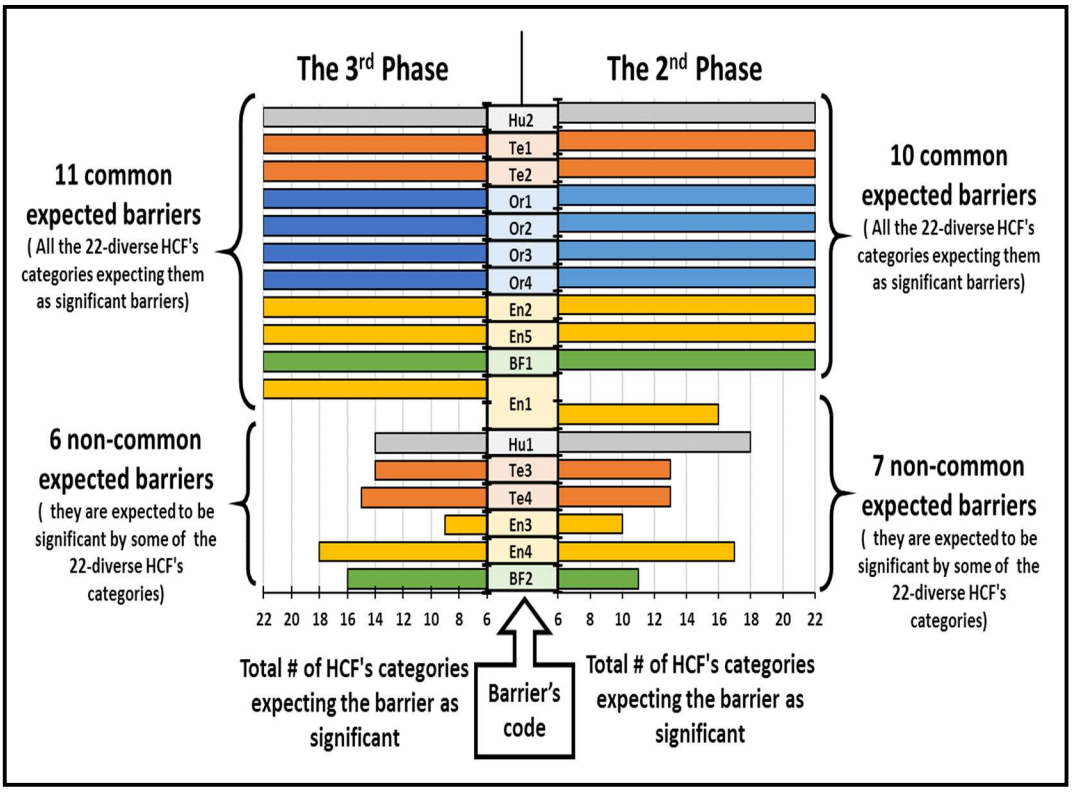

Figure 5.2 The Common Expected Barriers in the 2nd and 3rd Phases

In addition, the findings of the Kruskal—Wallis *H* test, which were used to find the *P*-value, determine that there are statistically significant differences between the perspectives of the 22-diverse categories of HCFs within the KSA regarding each barrier (*P*-value < 0.05).

The findings of the 3rd Phase have supported, validated, and proved the findings of the 2nd Phase as well as our argumentation/discussion, since they have supported,

validated, and proved that there is no consensus among all the 22-diverse HCFs' categories, regarding the significant influential strategic-level barriers to their decision to join the STN. Almost each one of them has its own unique subset of the 17 barriers of the initial version of the JoinSTNassistant Framework. Thus, this Framework could not and should not be a one-size-fits-all framework, applicable and used by all the 22-diverse HCFs within the KSA for assisting their decision to join the STN.

These findings, as discussed previously in Chapter 4, were expected and are compliant with the findings of other researchers who have argued that a given framework that leads to a successful implementation of one ICT innovation in a given country/organisation may not be suitable for the same ICT innovation within another country/organisation (Gilson & Raphaely, 2008; Cresswell & Sheikh, 2013; Yu, 2010; Westbrook et al., 2007). Furthermore, prior studies have asserted that each organisation will have its own unique sets of barriers which emerge from the characteristics of many dimensions, such as its strategy, plan, services provided, location, business drivers etc. (Healy, 2008; Gagnon et al., 2005; Cresswell & Sheikh, 2013; Baker, 2012; Bouwman et al., 2005). In addition, some of the barriers that limited the implementation of one ICT innovation within a given organisation, may no longer exist, be partly diminished, or become an opportunity for another organisation (Gilson & Raphaely, 2008; Baker, 2012).

5.5 Findings' Implications

The final outcome of the Third Phase aimed at validating the findings of the Second Phase by a representative sample size of the decision makers of HCFs across the KSA, in order to revise and modify the important influential strategic-level barriers of the JoinSTNassistant Framework for each one of the 22-diverse HCFs' categories regarding its decision to join the STN. Therefore, as shown in Figure 5.3, the old version of the JoinSTNassistant Framework, which was generated based on the findings of the Second Phase, has been revised and updated based on the findings of the Third Phase.

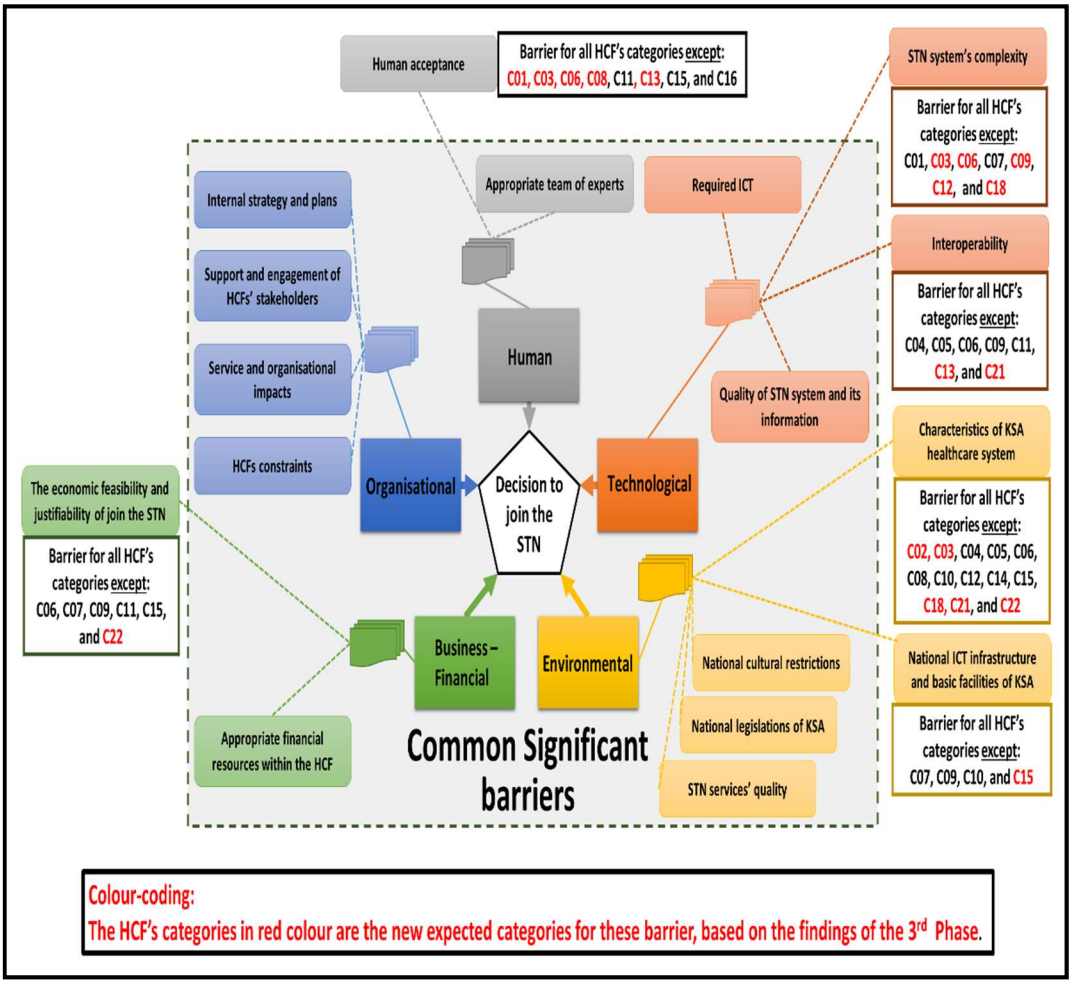

Figure 5.3 The Final Version of the JoinSTNassistant Framework

As shown in Figure 5.3 and Figure 5.4 the common significant barriers of the JoinSTNassistant Framework, which were 10 when based on the findings of the Second Phase, have been amended to be 11 barriers, based on the findings of the Third Phase. In addition, the other 6 barriers, which are not statistically significant for all 22-diverse HCFs' categories, have been also updated and revised, based on the findings of the Third Phase.

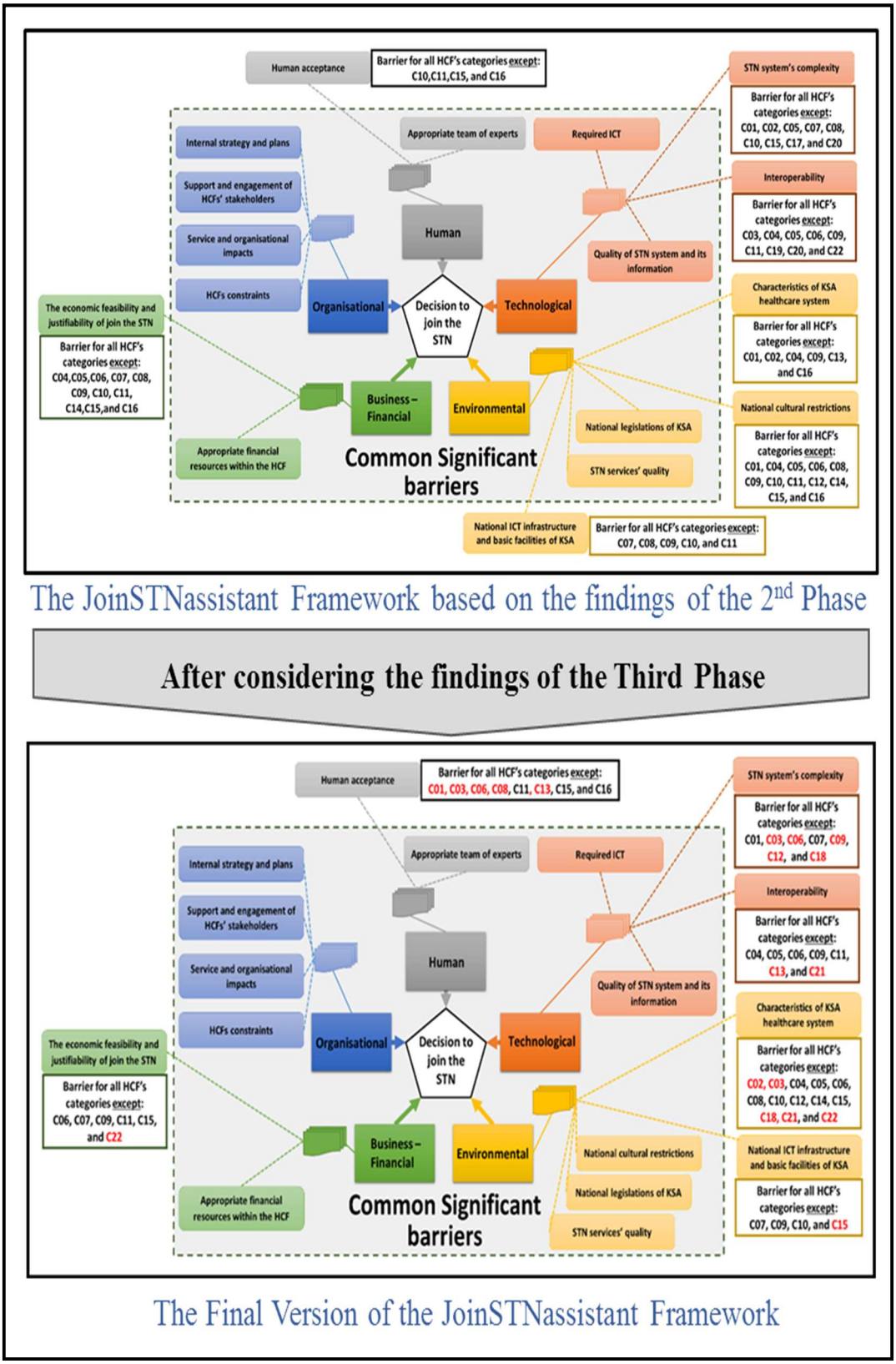

Figure 5.4 The Old Version Against the Final Version of the JoinSTNassistant Framework

For instance, Figure 5.5 shows the JoinSTNassistant Framework applicable for HCFs of C22 Category as it was at the end of the Second Phase, and how it has been revised and updated, based on the findings of the Third Phase.

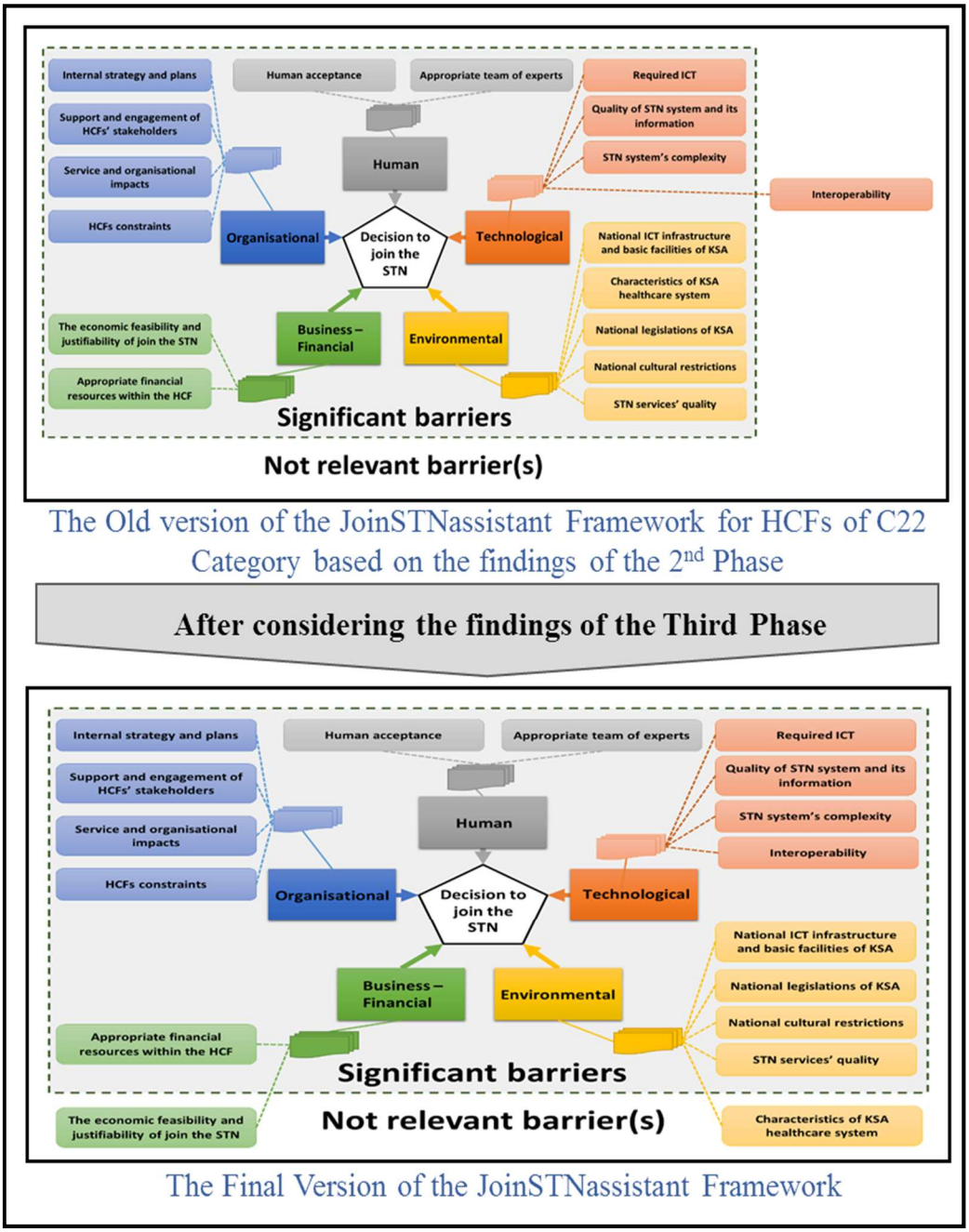

Figure 5.5 The Old Version Against the Final Version of the JoinSTNassistant Framework for HCFs of C22 Category

Figure 5.5 illustrates that the Te4 (interoperability) barrier was not a relevant barrier for HCFs of C22 Category, according to the findings of the Second Phase, because it was not expected by the 2nd Phase interviews' participants of the HCFs of C22 Category to be an important influential strategic-level barrier with respect to their HCFs' decision to join the STN. However, the findings of the 3rd Phase questionnaire indicate that the Te4 barrier is statistically significant to be an important influential strategic-level barrier for the HCFs of C22 Category. The findings of the 3rd Phase questionnaire also indicate that the En3 (Characteristics of KSA healthcare system)

and BF2 (The economic feasibility and justifiability of join the STN) barriers are not statistically significant important influential strategic-level barriers for the HCFs of C22 Category with respect to their decision to join the STN.

Figure 5.6 is another updating example, showing how the JoinSTNassistant Framework for HCFs of C10 Category has been revised and updated to be compatible with the findings of the Third Phase.

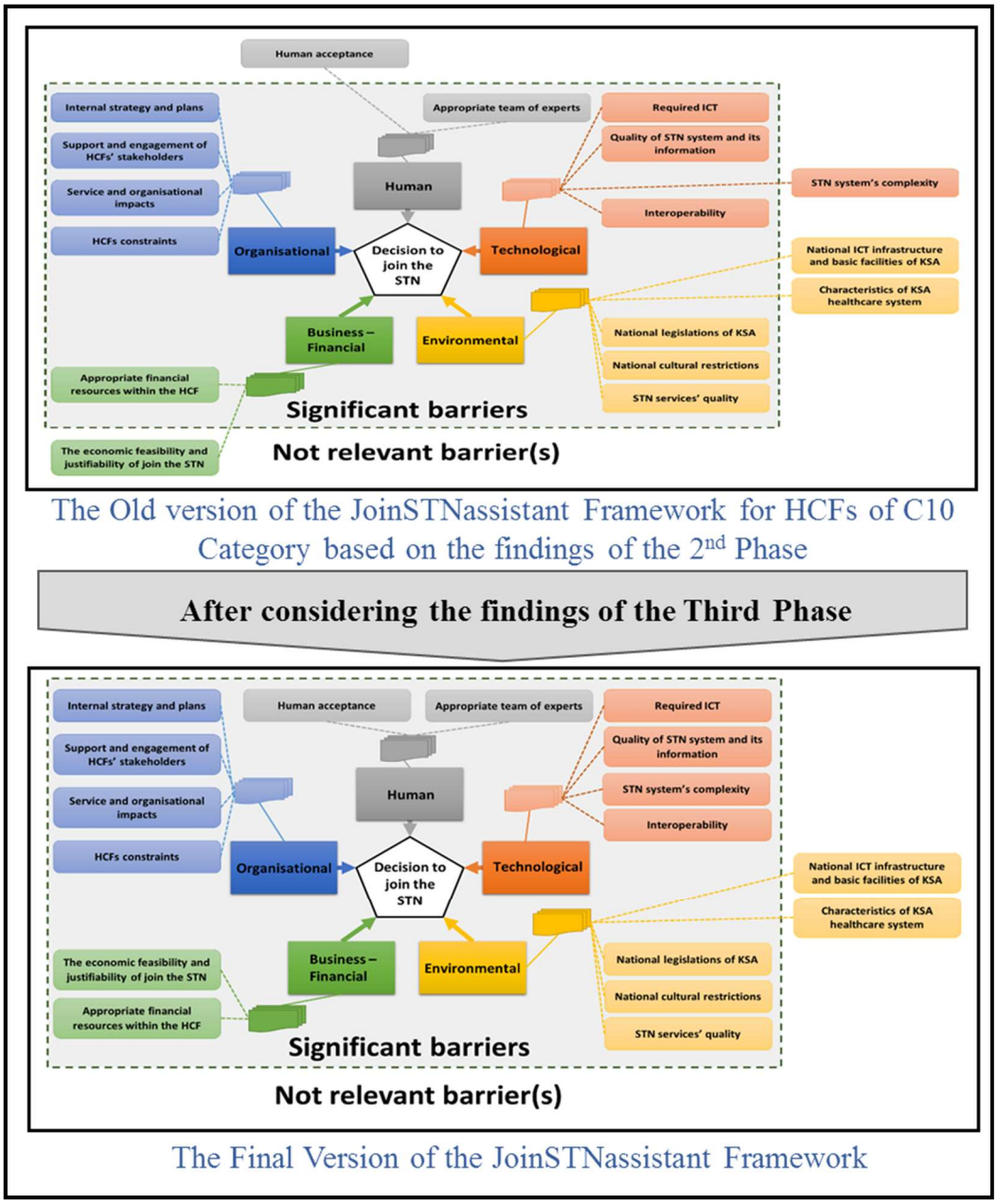

Figure 5.6 The Old Version Against the Final Version of the JoinSTNassistant Framework for HCFs of C10 Category

Figure 5.7 shows the three-sequential versions of the JoinSTNassistant Framework, which were developed through three-sequential phases, as mentioned in Chapter 1 and outlined in Chapters 3, 4, and this Chapter 5.

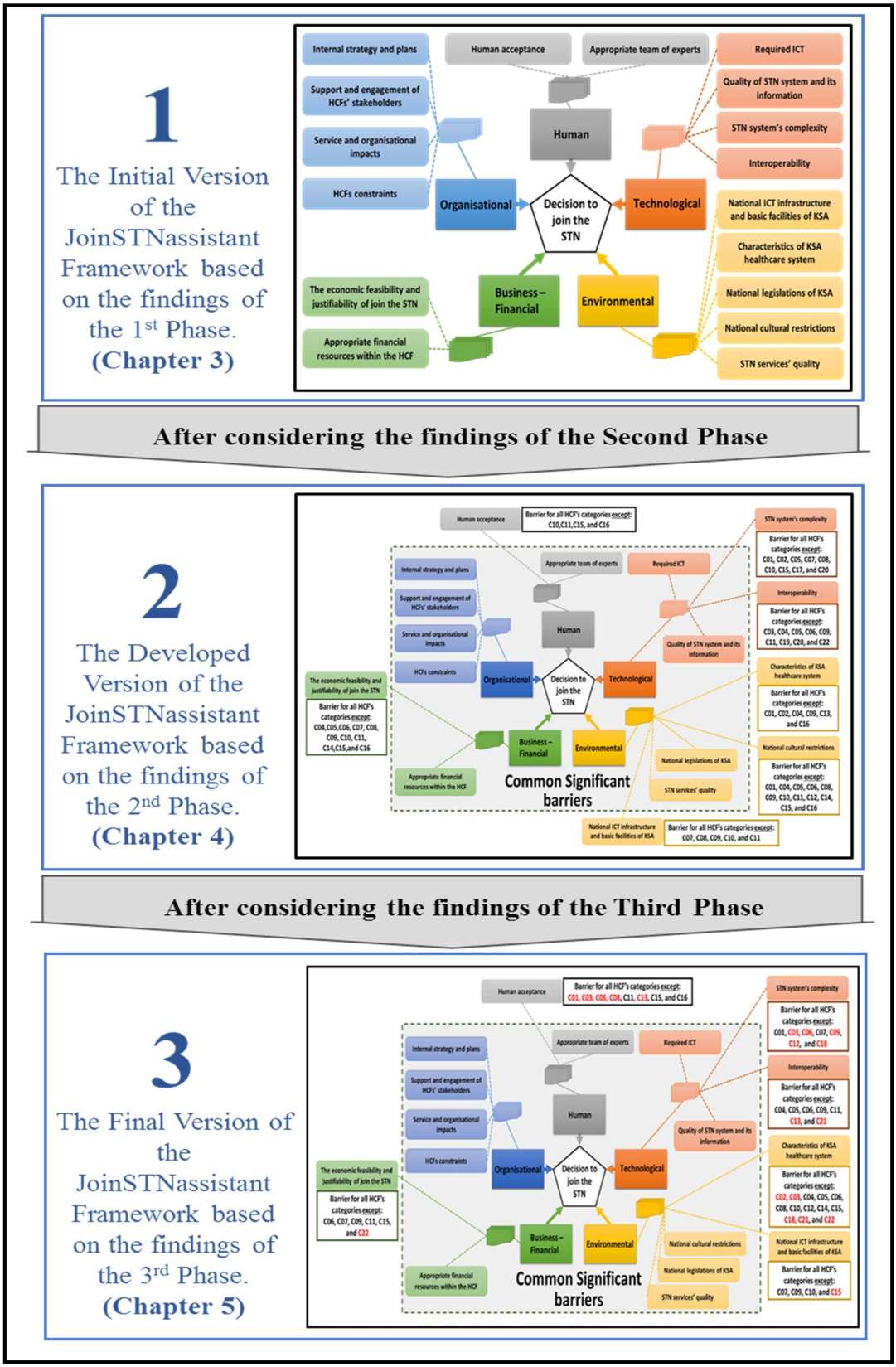

Figure 5.7 The Three-Sequential Versions of the JoinSTNassistant Framework

5.6 Conclusions

It was considered vitally important to involve as many potential users (i.e., strategic-level decision makers of the HCFs within the KSA) of the JoinSTNassistant

Framework as possible in its development, so as to ensure that it reflected their expectations and met their needs. This involvement was ensured by two stages of validation. The first stage was the "Second Phase" of development, covered in Chapter 4, and involved interviews with 81 strategic-level expert members of the STN-Communities of Practice (STN-CoP), representing all the 22-diverse categories of HCFs within the KSA. Accordingly, The JoinSTNassistant Framework were revised and updated to incorporate the findings of this 2nd Phase, referred to as the "Developed Version of the JoinSTNassistant Framework", as shown in Chapter 4 (Figure 4.3).

The second stage is the "Third Phase", covered in this Chapter 5, which implemented an even higher level of validation, involving as many as 905 potential users, forming a representative sample size of the decision makers of all HCFs across the KSA. They returned a specially designed questionnaire, and a quantitative method approach was used in analysing their answers. The Developed Version of JoinSTNassistant Framework has been further revised and updated to incorporate the findings of this 3rd Phase, and it will now be referred to as the "Final Version of the JoinSTNassistant Framework", as shown in Figure 5.3.

The findings of this 3rd Phase have complemented, supported, validated, and proved the findings of the 2nd Phase, as well as our argumentation/discussion. They have supported, validated, and proved that there is no consensus among all the 22-diverse HCFs' categories, regarding the significant influential strategic-level barriers to their decision to join the STN. Thus, this Framework could not and should not be considered as a one-size-fits-all framework, applicable and used as a monolithic entity by all the 22-diverse HCFs categories.

However, the methodology adopted and its three-phase implementation, have achieved an **articulated "Final Version Framework"** from which HCFs of any of the 22 categories can easily extract and use the well-defined subset that a representative sample of managerial staff of their own category has considered and approved as responding to the characteristics and needs of their category. This Final Version Framework, therefore, while it does not fit-all-sizes, should fit the sizes of all the HCFs within the KSA for assisting their decision to join the STN in a scientific, effective, sensible, and realistic way. This Chapter 5 represents the third and final phases of the three-sequential phases of the development of the JoinSTNassistant Framework. The findings of this Third Phase are used in Chapter 6, to develop and design a web-based application for the JoinSTNassistant Framework.

Chapter 6: The Web-Based Application of the JoinSTNassistant Framework

6.1 Introduction

The previous three chapters highlighted and discussed the three-sequential phases of the development of the JoinSTNassistant Framework. The final outcome of these three-sequential phases was the Final Version of the JoinSTNassistant Framework.

This chapter describes and discusses the development of a web-based application (i.e., portal) for the JoinSTNassistant Framework, referred to as "JoinSTNassistant Portal". This JoinSTNassistant Portal was developed to be a tool for modifying and adjusting the JoinSTNassistant Framework in order to be applicable for each one of the 22-diverse categories of the HCFs within the KSA. Furthermore, it was developed to be a tool for enabling the JoinSTNassistant Framework to be used by HCFs for assisting and guiding their decision to join the STN.

The following two sections of this chapter present and discuss the development and designing of the JoinSTNassistant Portal. Firstly, Section 6.2 highlights and discusses the decision-assist technique utilised by the JoinSTNassistant Framework.

Secondly, Section 6.3 presents an overview of the JoinSTNassistant Portal. This section explains how the JoinSTNassistant Portal will be utilised by the HCFs, the user's interface and templates of the JoinSTNassistant Portal, and the reports generated by the JoinSTNassistant Portal.

6.2 Decision-Assist Technique Utilised by the JoinSTNassistant Framework

O'Brien and Marakas (2011) have argued that the decision-assist technique that should be utilised by a given tool (e.g., framework, system, etc.) for assisting decision makers of an organisation to take a decision, should assist them throughout the decision-making process of their organisation. Furthermore, such a tool should offer and produce the types of information that are required and needed by the decision makers of this organisation to take the decision (O'Brien & Marakas, 2011). Therefore, as mentioned in Chapter 4, one of the aims of the Second Phase was to identify these aspects to be considered by the JoinSTNassistant Framework.

In the Second Phase, 81 strategic-level members of the STN-Communities of Practice (STN-CoP) were interviewed. Two of the discussed subjects were their perspectives

about the decision-making process of their HCFs to join the STN, besides the types of information needed, to reach a consensus for determining the following three points:

i. A suitable decision-assist technique(s) to be utilised by the JoinSTNassistant Framework.
ii. Key features that should be incorporated/considered into the JoinSTNassistant Framework.
iii. A measurable and tangible parameter/metric for each important influential barrier.

This section discusses the findings for these three points, and how these findings have been incorporated/considered into the JoinSTNassistant Framework.

The 81 strategic-level participants interviewed in the Second Phase, stated that the strategic and operational importance, advantages, and benefits of telemedicine for their HCFs are well-known and no longer questioned. They further stated that, nowadays, telemedicine is an essential component and plays a pivotal role in improving healthcare services provided by any HCF in the world. Consequently, they believed that all HCFs across the KSA are already convinced of the importance of telemedicine for their HCFs, and of joining the STN, since it is the only provider of telemedicine within the KSA. Therefore, they stated that the decision-making process of their HCFs will not be aimed at deciding whether or not joining the STN. However, it will be aimed at identifying and evaluating the proceedings and tasks that should be accomplished by the HCFs to join the STN successfully. Consequently, as shown in Figure 6.1, the findings of the Second Phase show that the decision-making process of the HCFs to join the STN will consist of two main stages, as follows:

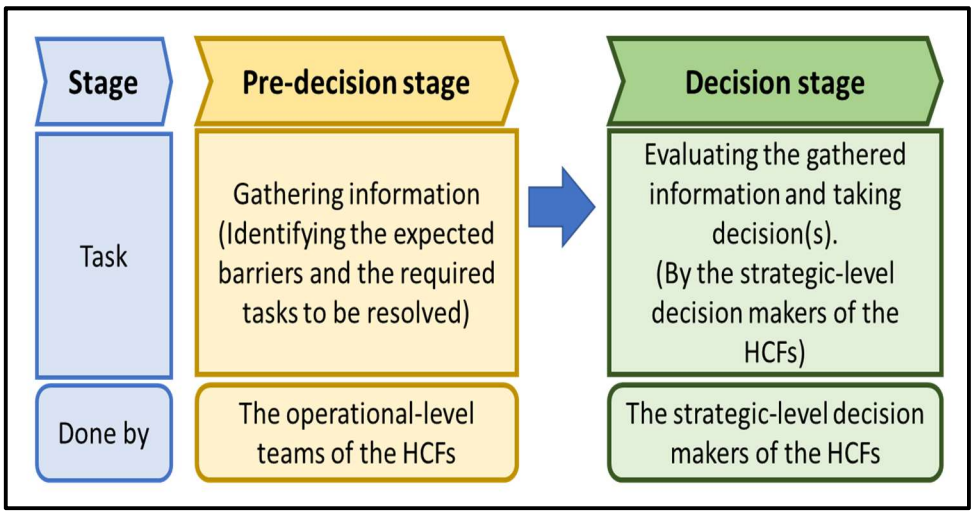

Figure 6.1 Main Stages of the Decision-Making Process of the HCFs to Join the STN

i. Pre-decision stage: Gathering information (identifying the expected barriers and the required tasks to be resolved)

In this stage, the relevant operational-level teams of each HCF will take responsibility for attempting to identify:

i. Expected barriers that could be faced by their HCF, associated with its decision to join the STN, and
ii. Required tasks/proceedings that must be accomplished by the HCF to resolve these expected barriers and join the STN.

For instance, the operational-level financial team of the HCF will take responsibility for attempting to identify expected financial barriers and quantify the required cost, and so on for the other relevant operational-level teams of the HCF.

The 81 strategic-level participants of the interviews stated that this stage is the basis for the decision stage. Poor/imperfect addressing/identifying of these barriers, of required proceedings or tasks, would cause the failure of the decision-making process to join the STN.

In terms of the expected challenges of this stage, the 81 strategic-level participants of the interviews stated that almost all HCFs will face challenges regarding identifying these barriers and required tasks/proceedings. Relatively few HCFs within the KSA currently have sufficient empirical experience and knowledge as needed to identify these barriers and required tasks/proceedings. This is because most HCFs of the KSA have not implemented and utilised telemedicine before, and the STN is the first national project for telemedicine within the KSA.

ii. Decision stage: Evaluating the gathered information and taking a decision

This stage is concerned with the evaluation and perspectives of strategic-level decision makers of the HCF, regarding the information gathered in the previous stage (the pre-decision stage). This decision stage is normally conducted by the HCF in the form of a series of brain-storming meetings. Each strategic-level decision maker will carefully analyse, evaluate and then express his/her perspective on the information gathered appropriately by the operational-level teams. Afterwards, when the strategic-level decision makers of the HCF accept the gathered information, they will send an approval to the operational-level teams of their HCF to start the process of joining the STN.

In terms of the expected challenges of this stage, the 81 strategic-level participants of the interviews agreed that one of the challenges that is normally faced by the strategic-level decision makers of the HCFs is that the operational-level teams of the HCFs often gather and provide complex, irrelevant, rushed, unnecessarily long, or inadequate information. O'Brien and Marakas (2011) have argued that complex, irrelevant, unnecessarily long and redundant information not only blurs and obfuscates the meaning, but also causes confusion and distraction in the mind of the decision makers (analysis paralysis mode), resulting in difficulty and delay in the decision-making process, or in making a wrong decision. They further stated that strategic-level decision makers do not need to understand and engage in every operational-level detail to take a decision. Therefore, the information provided to the strategic-level decision makers should be concise, accurately presented in an understandable manner/format (e.g., narrative, numeric, graphic, etc.), and sufficient to base a decision (O'Brien & Marakas, 2011).

These two-main stages reflect the fact that the HCFs' decision-making process to join the STN will be a structured and data-driven decision-making process. It will consist of interactions between the information gathered by the operational-level teams of the HCFs and the evaluations and perspectives of the strategic-level decision makers of the HCFs regarding this gathered information. Thus, the JoinSTNassistant Framework should utilise a suitable decision-assist technique that assists and guides the HCFs to accomplish successfully these two-main stages of their decision-making process, by resolving their challenges and by providing the types of information that are required. The existing literature contains several diverse decision-assist techniques utilised by different frameworks to assist strategic-level decision makers of a given organisation to make an organisational decision. Some of these decision-assist techniques would include the Analytical Hierarchical Process (AHP) technique (Saaty, 1990), the Case Based Reasoning (CBR) technique (Fan et al., 2011), the Fuzzy Decision Tree (FDT) technique (Olaru & Wehenkel, 2003), the Balanced Scorecard (BSC) technique (Dilla & Steinbart, 2005), and the checklist technique (Vennix et al., 1992).

The 81 strategic-level participants of the interviews also discussed these different decision-assist techniques, in order to reach a consensus for determining a suitable decision-assist technique(s) to be utilised by the JoinSTNassistant Framework. The findings of the discussion show that the AHP, CBR, FDT and BSC decision-assist techniques are not suitable for the JoinSTNassistant Framework concept. This is

because they are suitable for assisting the decision makers to select between alternatives, or to assess the extent to which the performance of their organisation will be influenced by their decision (Saaty, 1990; Fan et al., 2011; Olaru & Wehenkel, 2003; Dilla & Steinbart, 2005; Vennix et al., 1992). Also, there is no other alternative for the STN, since the STN is the only provider of telemedicine within the KSA, and the HCFs are already convinced of the importance of telemedicine and of joining the STN.

In contrast, the checklist decision-assist technique was chosen, as it is suitable for assisting the decision makers to find and evaluate the information needed for making a decision (Pullin et al., 2004; Vennix et al., 1992; Zhou et al., 2008). The success and completeness in taking a decision is increased by utilising the checklist technique, because it identifies points/items/tasks that should be considered or done in order to take a decision (Pullin et al., 2004; Vennix et al., 1992; Zhou et al., 2008). This is the essence of the JoinSTNassistant Framework concept, and is compatible with the decision-making process of the HCFs and with the needs of the strategic-level decision makers of the HCFs.

Therefore, the JoinSTNassistant Framework will utilise the checklist decision-assist technique to assist the HCFs to join the STN, and will generate checklist templates for each HCF. These templates will contain the following 3 points:

i. The specific important, influential strategic-level barriers associated with each HCF's decision to join the STN, based on its category. As discussed in Chapter 4 and 5, it has been demonstrated and proved that almost each one of the 22-diverse HCFs' categories has its own unique subset of the 17 barriers of the JoinSTNassistant Framework.
ii. The required tasks/proceedings that must be accomplished by the HCFs to resolve their expected barriers.
iii. The specified requirements (e.g., ICT infrastructure, devices, camera, medical equipment, etc.) that are required by the STN to be available and of the required standard in the HCFs sites in order to join the STN. As discussed in Chapter 2, each HCFs' category has different requirements, which must be available and of the required standard in the HCFs sites in order to join the STN. For instance, the STN will require from each HCF site

> within HCFs' Category 1 and Category 2 to have its own data centre, specific number of ICT staff, and its own qualified help disk staff, whereas each HCF site within Category 7 and Category 9 will be allowed to use the STN's cloud data centre and the STN help disk staff.

The operational-level teams of the HCFs should complete these checklist templates by providing information regarding each item of these templates, to be evaluated by the strategic-level decision makers of the HCFs. Further details about the checklist templates and the steps that must have been completed by the operational-level teams of the HCFs are presented in Section 6.3.

There is an old management adage (principle), which is 'you can't manage what you don't measure' (Bohn, 1998). Thus, the 81 strategic-level interviews' participants were also asked in the Second Phase to reach a consensus for determining a measurable and tangible parameter/metric for each barrier of the JoinSTNassistant Framework. They were also asked to determine the types of information required by the strategic-level decision makers and to be provided by the operational-teams, in order to be considered and utilised by the JoinSTNassistant Framework for assisting each HCF to manage its progress of resolving its barriers.

Table 6.1 summarises the findings of the discussion. This table lists the 17 barriers of the JoinSTNassistant Framework, using the codes described in Chapter 3 (Table 3.4) against its measurable parameter, types of required information, and the colour coded to improve the understanding.

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Table 6.1 Barriers of the JoinSTNassistant Framework Against its Measurable Parameter, Types of Required Information, and Colour Code Meaning

The pillar	Barrier's code	The measurable and tangible parameter	Types of information required by the strategic-level decision makers to be provided by the operational-teams	Colour code meaning
Human	**Hu1**	The % of HCFs' consumers and clinical staffs who accept and willing to use telemedicine or to be treated by use of telemedicine.	• The % of HCFs' consumers and clinical staffs who accept and are willing to use telemedicine or to be treated by use of telemedicine • If the % less than 50% - How could the HCF increase the % of the acceptance. (Required conditions/tasks). - Estimated total cost in order to increase the % of the acceptance. - Responsible/dedicated person(s) within the HCF	• Green (▲) = The % of the acceptance is more than 75%. • Yellow (⬣) = The % of the acceptance (50% -75%). • Red (▼) = The % of the acceptance is less than 50%
	Hu2	The # of required experts within the HCF to implement, operate, and maintain the STN	• If there is any shortage within the HCF: - Who are they - Estimated total cost (salary) and date that are required to be hired within the HCFs - Responsible/dedicated person(s) within the HCF	• Green (▲) = All of them are available within the HCF. • Yellow (⬣) = Some of them **<u>are Not</u>** available but they could be hired. • Red (▼) = Some of them **Not** available and could **<u>Not</u>** be hired.
Organisational	**Or1**	The # of required tasks that have been rejected/being delayed by any stakeholder (department) within the HCF to be available/equipped within the HCF	• If there is a delay or some/all of required tasks have been **rejected**: - What are they and the reason(s). - Responsible/dedicated person(s) within the HCF	• Green (▲) = All of them have been accepted. • Yellow (⬣) = some/all of them have been accepted**,** but there is a delay. • Red (▼) = some/all of them have been **rejected**.
	Or2	The availability of internal strategy and plans for joining the STN, particularly change management plan, project management plan, and strategic plan.	• If some/all of strategy and plans **<u>are Not</u>** available: - What are they and the reason(s). - Estimated date and total cost to be prepared. • Responsible/dedicated person(s) within the HCF.	• Green (▲) = all of them are available. • Yellow (⬣) = some/all of them **<u>are Not</u>** available, but they could be prepared. • Red (▼) = some/all of them **<u>are Not</u>** available and could **<u>Not</u>** be prepared.
	Or3	The # of required tasks that have been rejected by any stakeholder (department) within the HCF to be available/equipped within the HCF due to organisational constraints	• If any required tasks have been **rejected**: - What are they and the reason(s). - If the organisational constraints could be amended: • If the organisational constraints could be amended: - What are they. - Estimated date and total cost to be prepared. • Responsible/dedicated person(s) within the HCF.	• Green (▲) = all of them have been accepted. • Yellow (⬣) = some/all of them have been rejected**,** but the organisational constraints could be amended. • Red (▼) = some/all of them have been **rejected** and the organisational constraints could **<u>Not</u>** be amended.

The pillar	Barrier's code	The measurable and tangible parameter	Types of information required by the strategic-level decision makers to be provided by the operational-teams	Colour code meaning
	Or4	The extent to which the HCF and its healthcare services will be impacted by joining and utilising the STN within the HCF	• If there is not any impact or there are negative impacts: - What are they and the reason(s). • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Positive impacts. • Yellow (⬣) = **No** any impact. • Red (▼) = Negative impacts.
Technological	**Te1**	The extent to which the specific required ICT by the STN are available/equipped within the HCFs sites in order to join the STN	• For those that are **Not** available/equipped within the HCFs sites, but they could be purchased: - What are they - Estimated total cost and date that are required to be available/equipped within the HCFs sites - Responsible/dedicated person(s) within the HCF • For those that are **Not** available/equipped within the HCFs sites and could **Not** be purchased: - What are they and the reason(s). • Responsible/dedicated person(s) within the HCF.	• Green (▲) = All of them are available/equipped within the HCFs sites. • Yellow (⬣) = Some/all of them are **Not** available/equipped within the HCFs sites, but they could be purchased from the STN agency or the local-marketplace. • Red (▼) = Some/all of them are **Not** available/equipped within the HCFs sites and could **Not** be purchased from the STN agency or the local- marketplace.
	Te2	The extent to which the organisational-level teams within the HCF are satisfied with the quality of STN system and its information, in terms of its reliability, security, confidentiality, privacy, accuracy, completeness, usefulness, ease of understanding, and relevancy.	• If they are somewhat or are **Not** satisfying: - What is the reason(s)? • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Satisfying. • Yellow (⬣) = Some-what satisfying. • Red (▼) = **Not** satisfying.
	Te3	The degree by which the STN systems are perceived by the organisational-level teams within the HCF as difficult to be implemented, operated, and/or maintained	• If they are somewhat difficult or are difficult: - What is the reason(s)? • Responsible/dedicated person(s) within the HCF.	• Green (▲) = **Not** difficult. • Yellow (⬣) = Some-what difficult. • Red (▼) = Difficult.
	Te4	The extent to which the STN systems are interoperable with the existing ICT systems of the HCF	• If they are Partly or **Not** interoperable: - With which existing ICT system(s) of the HCFs and why? - Estimated total cost and date that are required in order to change the existing ICT system(s) of the HCF. • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Interoperable. • Yellow (⬣) = Partly interoperable. • Red (▼) = **Not** interoperable.

The pillar	Barrier's code	The measurable and tangible parameter	Types of information required by the strategic-level decision makers to be provided by the operational-teams	Colour code meaning
Environmental	**En1**	The extent to which the STN systems are compatible with the underlying beliefs, values and norms of the society in which the HCF provide healthcare services.	• If they are Partly or **Not** compatible: - What is the reason(s)? - Responsible/dedicated person(s) within the HCF.	• Green (▲) = Compatible. • Yellow (⬣) = Partly compatible. • Red (▼) = **Not** compatible.
	En2	The availability of national legislations within the KSA to govern issues related to the usage of the STN	• If they are Partly or **Not** available: - What are they • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Available. • Yellow (⬣) = Partly available. • Red (▼) = Not available.
	En3	The types of external pressures (e.g., from the MOH, partners, etc.)	• Who? And how? • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Positive external pressures. • Yellow (⬣) = **No** external pressures. • Red (▼) = **Negative** external pressures.
	En4	The level of quality and support of the national ICT infrastructure and basic facilities in the surrounding area of the HCFs	• If they are Somewhat or **Not** satisfying: - What is the reason(s)? • Responsible/dedicated person(s) within the HCF	• Green (▲) = Satisfying. • Yellow (⬣) = Some-what satisfying. • Red (▼) = **Not** satisfying.
	En5	The level of performance, supportability, stability, and functionality of the STN and its services	• If they are Somewhat or **Not** satisfying: - What is the reason(s)? • Responsible/dedicated person(s) within the HCF	• Green (▲) = Satisfying. • Yellow (⬣) = Some-what satisfying. • Red (▼) = **Not** satisfying.
Business-financial	**BF1**	The availability of adequate financial resources within the HCF sites to be equipped with the requirements necessary for joining the STN and to operate and maintain its own ICT infrastructure and equipment	• Estimated total cost (budget) • Estimated financial shortfall • How can it be managed? • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Available. • Yellow (⬣) = There is a financial shortfall, but it can be managed • Red (▼) = There is a financial shortfall and can **Not** be managed.
	BF2	The results of the economic feasibility and justifiability of join the STN for the HCF	• Expected profits/ losses (Return On Investment (ROI)) • Responsible/dedicated person(s) within the HCF.	• Green (▲) = Positive economic benefits. • Yellow (⬣) = **No** economic benefits. • Red (▼) = **Negative** economic benefits.

6.3 Overview of the JoinSTNassistant Portal

This section describes and discusses the web-based application (JoinSTNassistant Portal) of the JoinSTNassistant Framework. The JoinSTNassistant Portal is an empowering tool aimed at assisting and guiding HCFs in their decision to join the STN.

In order to achieve this, each HCF has to complete the following steps:

I. First step: Logging in to the JoinSTNassistant Portal

As shown in Figure 6.2, each HCF has to enter its account information (user name and password) in order to access to the JoinSTNassistant Portal. The HCF has to contact the STN agency if it does not have an account.

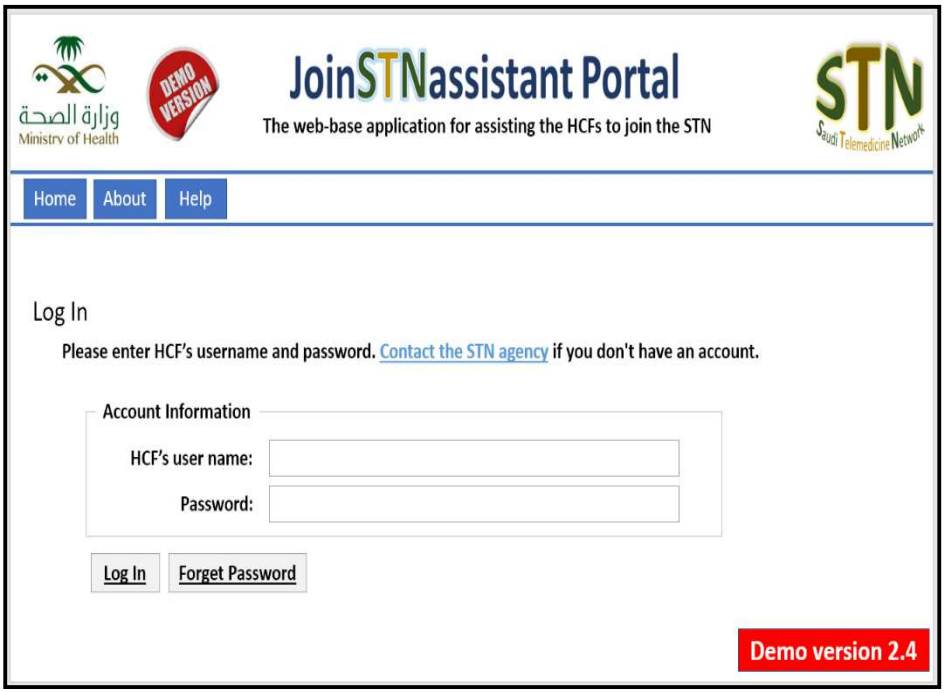

Figure 6.2 Login page of the JoinSTNassistant Portal

Once the HCF have logged in successfully, the JoinSTNassistant Portal will fetch accurate data of the HCF from the database of the HCFs account information. This data will enable the JoinSTNassistant Portal to:

i. Modify and adjust the JoinSTNassistant Framework so as to make it applicable to this HCF of the KSA, based on its category. This will be done by fetching from the Framework's database of the specific important, influential strategic-level barriers associated with each HCF's decision to join the STN, those based on this HCF category.

ii. Identify the specified requirements (e.g., ICT infrastructure, devices, camera, medical equipment, etc.) that are required by the STN to be available and of the required standard in the HCF sites in order to join the STN, by fetching these data from the database of the STN requirements.

Next, the JoinSTNassistant Portal utilises these data to generate electronic checklist templates. These templates have to be completed by the operational-level teams of the HCF, via the JoinSTNassistant Portal, in the next step.

Figure 6.3 illustrates the architecture diagram of the JoinSTNassistant Portal.

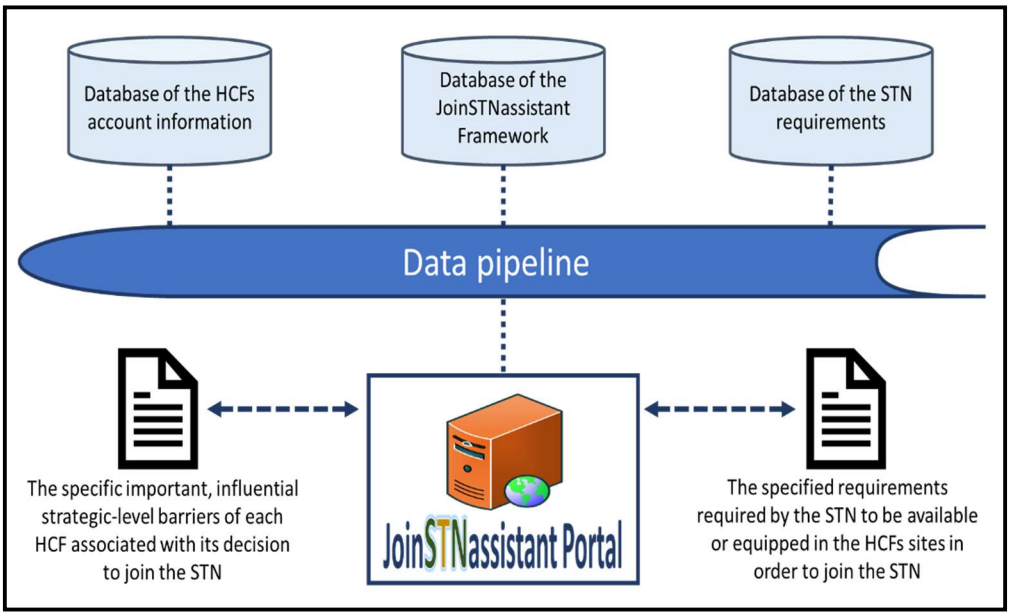

Figure 6.3 Architecture Diagram of the JoinSTNassistant Portal

II. Second step: Completing the electronic checklist templates generated by the JoinSTNassistant Portal

This step reflects the first stage (the pre-decision stage) of the two-main stages of decision-making process of the HCFs to join the STN. Therefore, for each of the 5 pillars of the JoinSTNassistant Framework (Human, Organisational, Technological, Environmental, and Business–financial pillars), the JoinSTNassistant Portal will generate an electronic checklist template.

Each of the generated electronic checklist templates for each pillar contains the following:

i. The specific important and influential strategic-level barriers of this pillar associated with each HCF's decision to join the STN, based on its category.

ii. The required tasks that must be accomplished by the HCFs to resolve each barrier.

iii. The specified requirements (e.g., ICT infrastructure, devices, camera, medical equipment, etc.) that are required by the STN to be available and of the required standard in the HCFs sites in order to join the STN.

Each relevant operational-level team of HCF must use the JoinSTNassistant Portal to complete its relevant electronic checklist template(s) by providing specific information regarding each item of these electronic templates. For instance, the operational-level financial team of the HCF has to complete the electronic checklist template(s) of the Business–financial pillar, while the operational-level ICT team of the HCF has to complete the electronic checklist template(s) of the Technological pillar, and so on.

The JoinSTNassistant Portal will generate the electronic checklist templates with content controls (i.e., fillable fields (text boxes) and/or multiple-choice lists). Thus, for each item of the electronic checklist templates, the JoinSTNassistant Portal will allow the relevant operational-level teams of HCF to provide/enter only those types of information required by the strategic-level decision makers to be provided by the operational-teams, as discussed and shown in Table 6.1. Figure 6.4 illustrates a screenshot of an example of the operational-level user's interface of the JoinSTNassistant Portal for one of the electronic checklist templates of Human pillar.

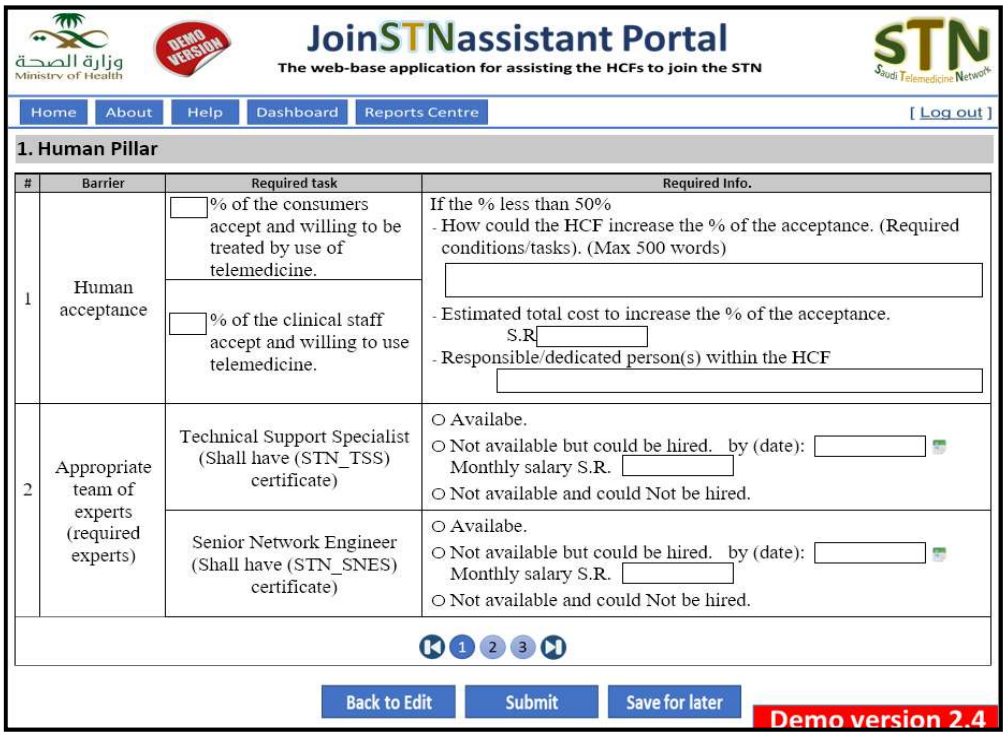

Figure 6.4 Screenshot of the Operational-Level User's Interface of the JoinSTNassistant Portal for Human Pillar

Figure 6.5 illustrates a screenshot of an example of the operational-level user's interface of the JoinSTNassistant Portal for one of the electronic checklist templates of the Organisational pillar, which has to be completed by the relevant operational-level team of the HCF.

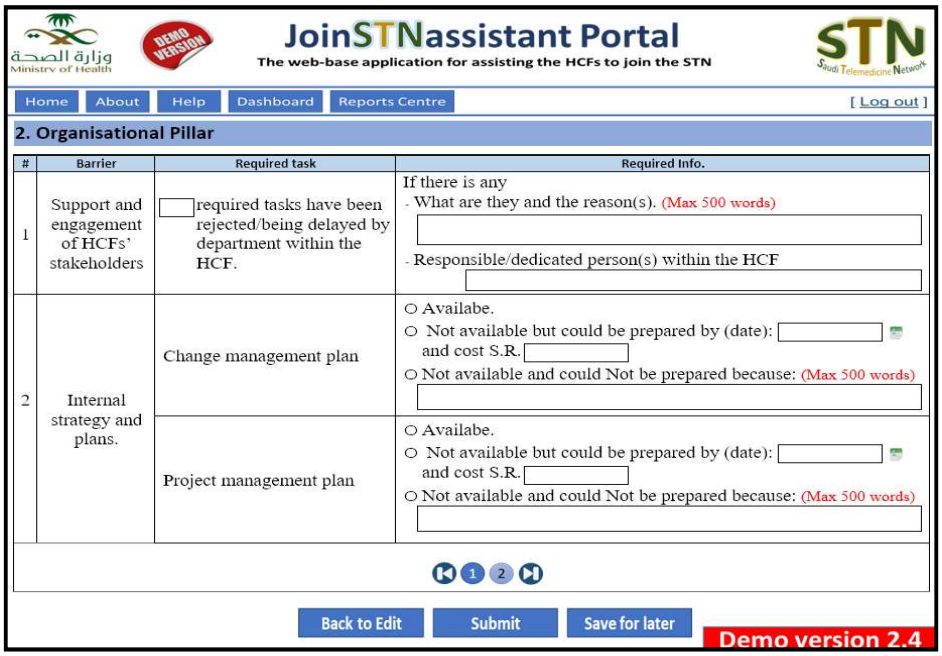

Figure 6.5 Screenshot of the Operational-Level User's Interface of the JoinSTNassistant Portal for Organisational Pillar

Figure 6.6 illustrates a screenshot of an example the operational-level user's interface of the JoinSTNassistant Portal for one of the electronic checklist templates of the Technological pillar.

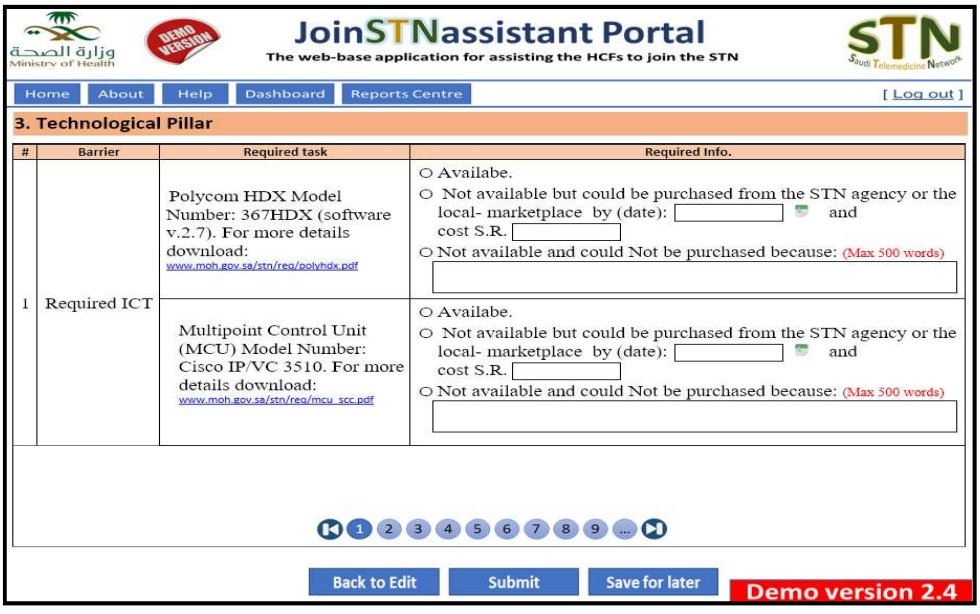

Figure 6.6 Screenshot of the Operational-Level User's Interface of the JoinSTNassistant Portal for Technological Pillar

Figure 6.7 and Figure 6.8 illustrate a screenshot of an example the operational-level user's interface of the JoinSTNassistant Portal for one of the electronic checklist templates of the Environmental and Business-Financial pillars, respectively.

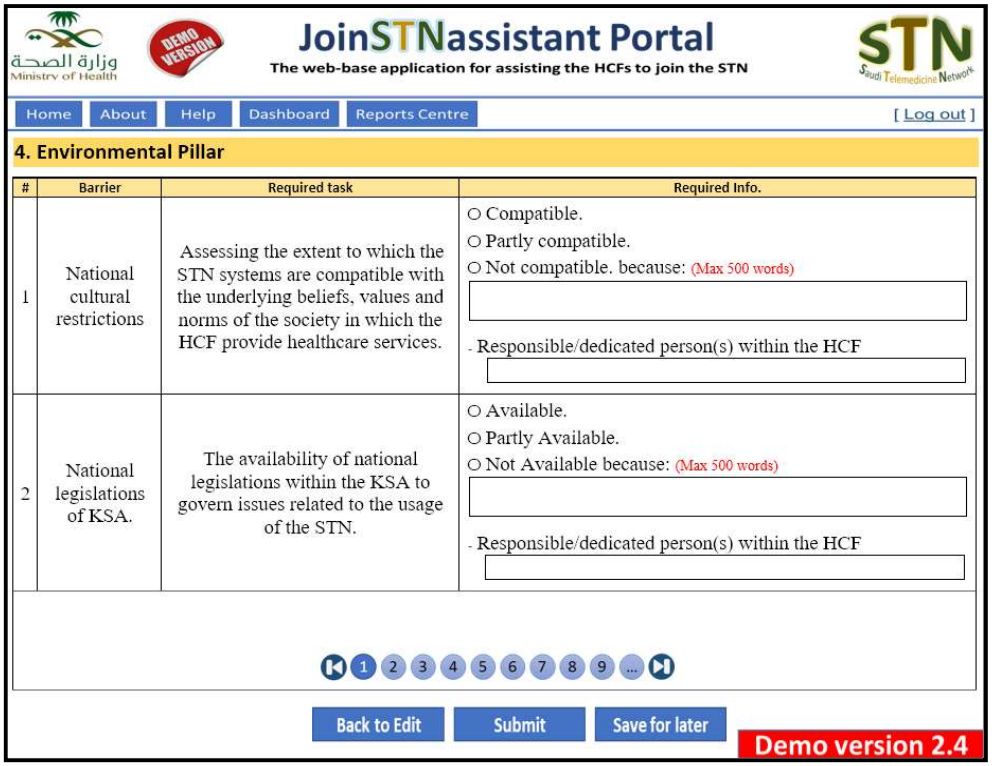

Figure 6.7 Screenshot of the Operational-Level User's Interface of the JoinSTNassistant Portal for Environmental Pillar

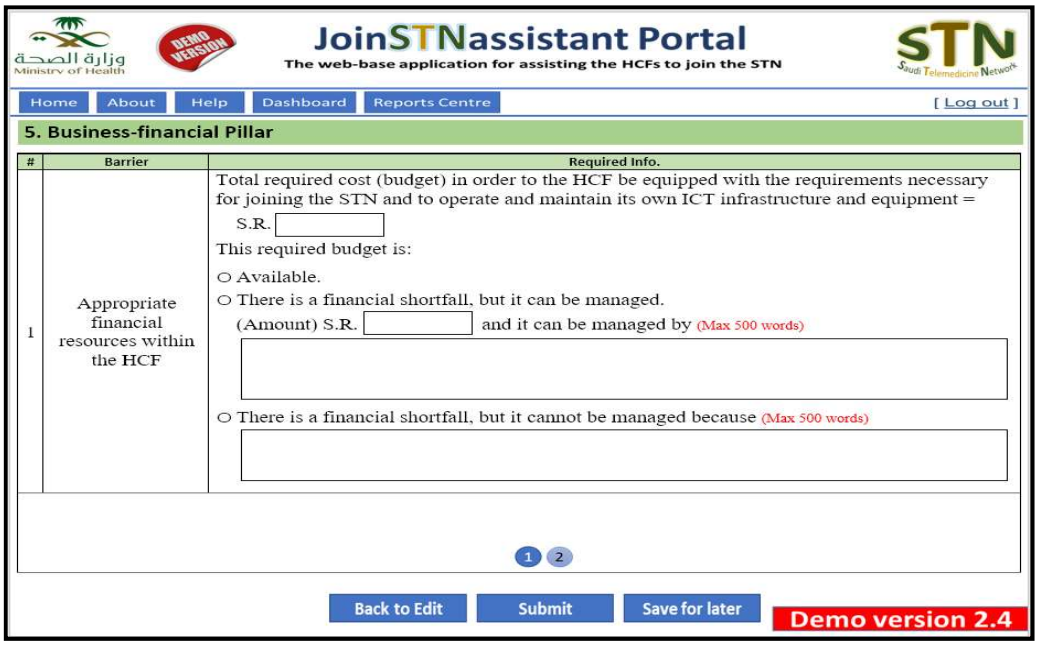

Figure 6.8 Screenshot of the Operational-Level User's Interface of the JoinSTNassistant Portal for Business-Financial Pillar

i. Third step: Generating reports for the strategic-level decision makers of the HCF

Once the operational-level teams of the HCF have provided the required information and submitted the electronic checklist templates successfully, for each pillar of the JoinSTNassistant Framework, the JoinSTNassistant Portal can generate a report for the strategic-level decision makers. These reports are designed to be compatible with the needs and requirements of the strategic-level decision makers of the HCFs, as discussed and as shown in Table 6.1.

For instance, Figure 6.9 illustrates an example of two-different reports related to the Human pillar for the strategic-level decision makers of two diverse HCFs (HCF1 and HCF2). As shown in this figure, the two-different reports of Human pillar present only the information that is needed and required by the strategic-level decision makers of the HCFs, as discussed and shown in Table 6.1. As shown in this figure, the report of HCF1 shows that all the barriers of the Human pillars, their required tasks/proceedings, and their required specified requirements, have been resolved and/or equipped by the HCF1 (the colour code for all of them is green (▲)).

In contrast, the report of HCF2 shows that all the barriers of the Human pillars, their required tasks/proceedings, and their required specified requirements have not been resolved and/or equipped by the HCF2 and they suffer minor challenge(s) that could be resolved by the HCF2 (the colour code for all of them is yellow (⬣)). Therefore, each one of these two-different reports contains different information, based on the needs and requirements of the strategic-level decision makers of the HCFs, as discussed and shown in Table 6.1.

Figure 6.10 illustrates another example of two-different reports related to the Organisational pillar for the strategic-level decision makers of two diverse HCFs (HCF1and HCF2). One of them (HCF1) where all its barriers of Organisational pillar and all their required tasks are available/resolved (the colour code for all of them is green (▲)). Whereas, for the HCF2, some of its barriers of Organisational pillar or some of their required tasks are **Not** available/resolved and they suffer minor challenge(s) that could **Not** be resolved by the HCF2 (the colour code for all of them is red (▼)).

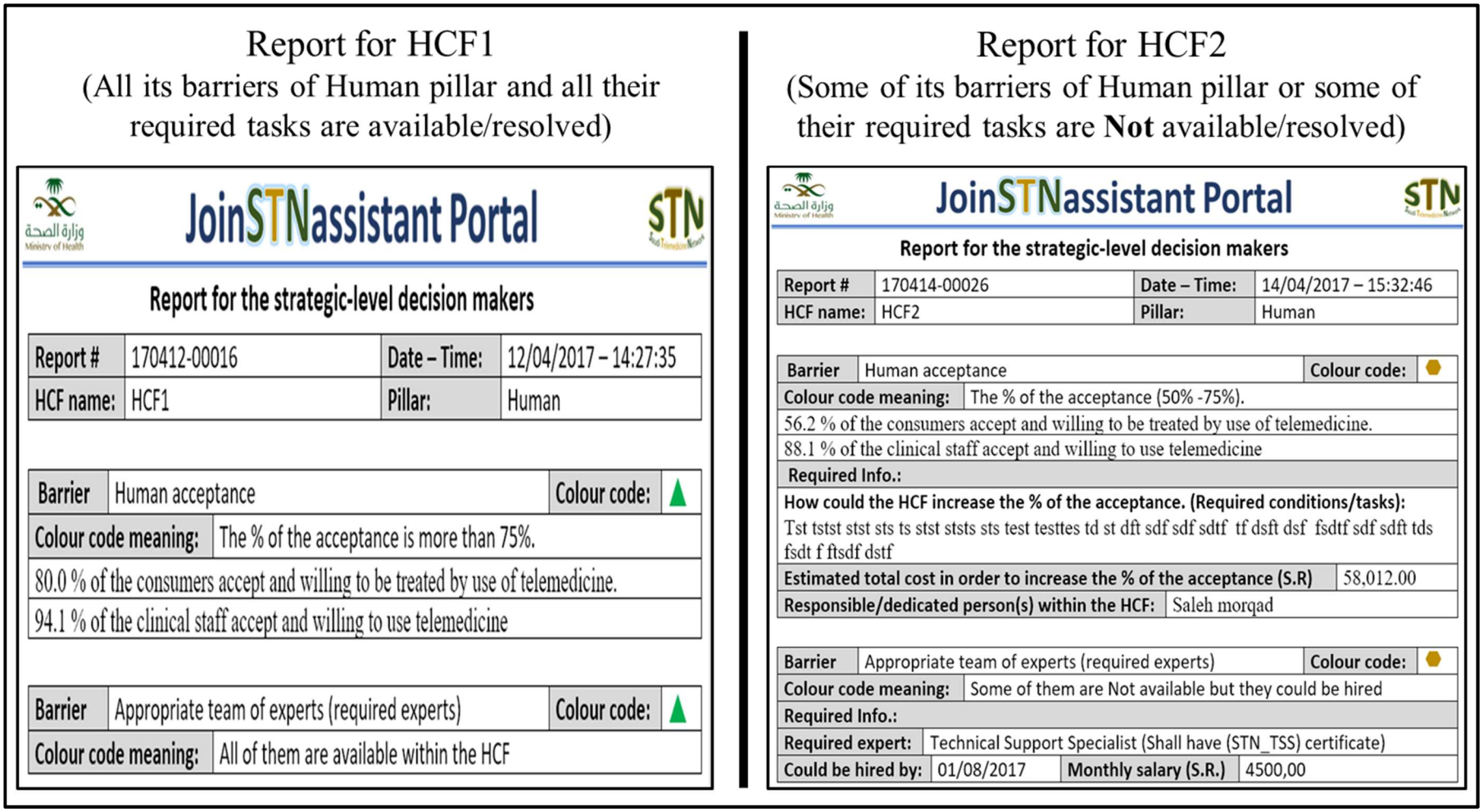

Figure 6.9 Example of 2-Different Reports of Human Pillar for the Strategic-Level Decision Makers of 2 Diverse HCFs (HCF1and HCF2)

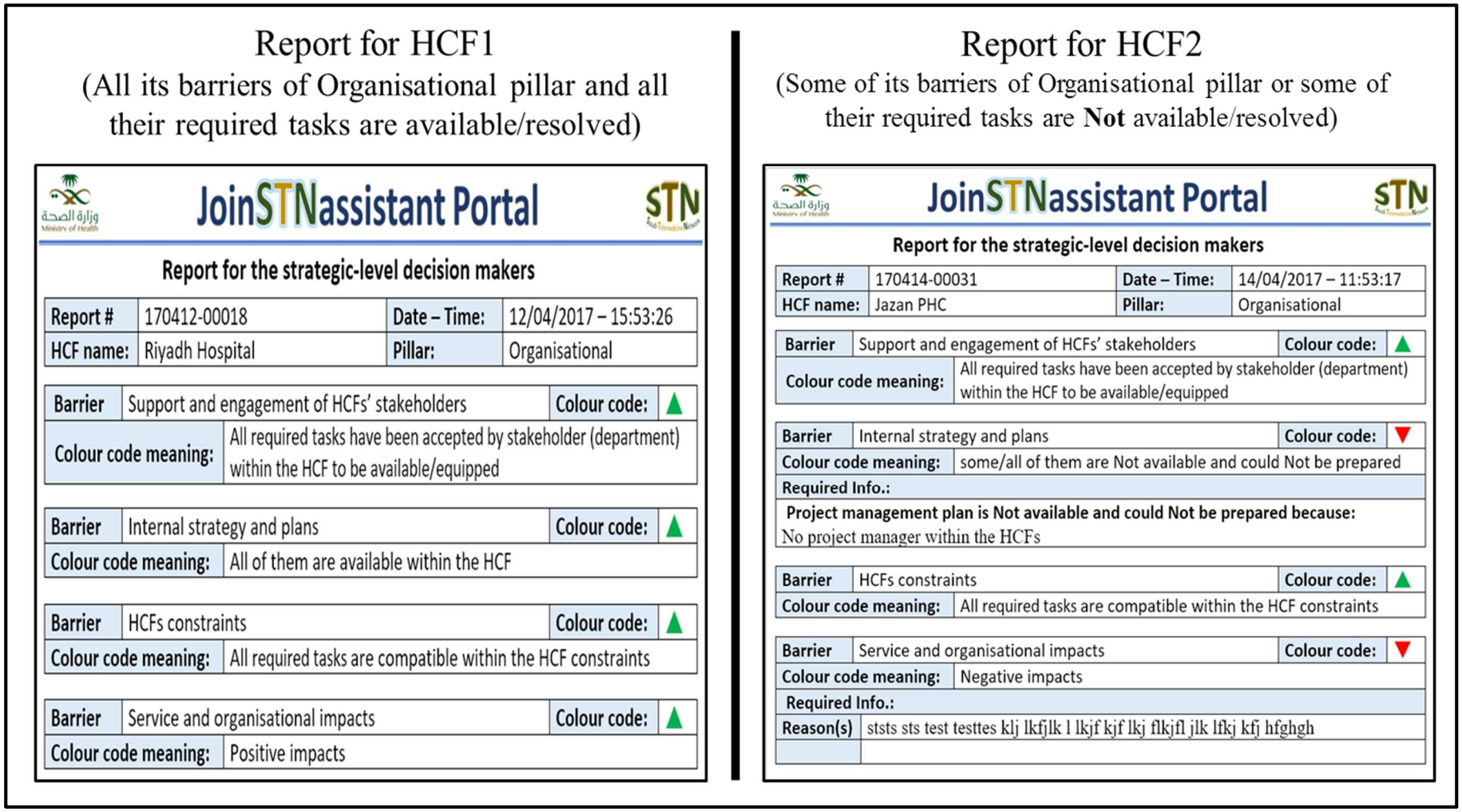

Figure 6.10 Example of 2-Different Reports of Organisational Pillar for the Strategic-Level Decision Makers of 2 Diverse HCFs (HCF1and HCF2)

6.4 Conclusions

The JoinSTNassistant Portal, presented in this chapter, was developed to make the JoinSTNassistant Framework accessible to all the HCFs of the KSA, covering all the 22 different HCF categories. It has been designed to provide a powerful and user-friendly tool for assisting all KSA's HCFs, in reaching a decision to join the STN.

The main aim was to make the Portal simple to use and to overcome the problem of the vast different characteristics and requirements of the 22 KSA's HCF Categories. These differences have been determined and incorporated in the Framework and the Portal in an articulated, flexible way that allows the Portal to select, extract and provide the information that is specific to and needed by the enquiring HCF.

As it was considered vitally important to involve the potential users (i.e., strategic-level decision makers of the HCFs within the KSA) of the JoinSTNassistant Framework in its development, their involvement was also considered vitally important in the development and designing of the web-based application (Portal) for this Framework, referred to as the "JoinSTNassistant Portal", so as to ensure that it reflected their expectations and met their needs.

This involvement was ensured by interviewing and discussions with 81 strategic-level decision makers, representing the 22 categories of KSA's HCFs, regarding their perspectives about the decision-making process of their HCFs to join the STN, and the types of information required for the proposed JoinSTNassistant Portal to be compatible with their needs and requirements about their HCF decision-making process to join the STN.

The JoinSTNassistant Portal, represented in this chapter, together with the Final Version of the JoinSTNassistant Framework, represented in Chapter 5, are validated and evaluated by their potential users (i.e., strategic-level decision makers of the HCFs within the KSA). The next chapter discusses and highlights this step and its findings.

Chapter 7: Validation and Evaluation

7.1 Introduction

Chapter 6 highlighted and discussed the JoinSTNassistant Portal, which has been designed and implemented to be a powerful tool for enabling the Final Version of the JoinSTNassistant Framework to be accessible and used by all 22 categories of HCFs within the KSA for assisting and guiding their decision to join the STN.

This chapter introduces and discusses the validation and evaluation study of the JoinSTNassistant Portal. Section 7.2 highlights the type and scope of this validation and evaluation study, while the selected criteria are discussed in Section 7.3.

Section 7.4 explains the validation and evaluation methodology. This section explains the approach and design of the validation and evaluation study, the selection procedure and eligibility criteria of the participants, as well as the data analysis method adopted.

Section 7.5 presents and discusses the findings and their implications, and explains the changes made to the JoinSTNassistant Portal based on the findings of the validation and evaluation and the feedback received.

7.2 Type and Scope of Validation and Evaluation

Scriven (1996), Gruhn (1991), and Nazareth (1989) have stated that the validation and evaluation are two different and complementary tests, and both must be conducted. The validation of a given human-computer interaction (e.g., ICT application, tool, system) is the process of assessing it, to determine whether it meets actual needs and requirements of its potential users or/and consumers (Patton, 1990; Gruhn, 1991; Nazareth, 1989; Nielsen, 1999).

The evaluation is broader in scope than the validation, and it is the process of assessing a given human-computer interaction (e.g., ICT application, tool, system) to determine its usefulness and sufficient value to its potential users or/and consumers, in terms of enabling them to do or accomplish something that either could not be done before, or to do it better or faster than they could before (Patton, 1990; Gruhn, 1991; Nazareth, 1989; Nielsen, 1999). Therefore, a given application may meet actual needs and requirements of its users or/and consumers, but it may still not be of sufficient value to them (Patton, 1990; Gruhn, 1991; Nazareth, 1989; Nielsen, 1999).

As discussed in Chapter 6, the operational-level teams of the HCFs must use the JoinSTNassistant Portal to complete their relevant electronic checklist template(s).

Afterwards, once they have submitted the electronic checklist templates successfully, the JoinSTNassistant Portal can generate a report for the strategic-level decision makers, for assisting and guiding their decision to join the STN. These reports have been designed to provide and present specific information in a specific manner or format, based on the needs, requirements, and specifications of the 81 strategic-level members of the STN-CoP identified and shown in Chapter 6 (Table 6.1).

The domain of the operational-level teams of the HCFs (e.g., their proceedings, tasks, challenges, etc.) is beyond the scope of this PhD research (i.e., the JoinSTNassistant Framework). Consequently, the validation and evaluation study of the JoinSTNassistant Portal focused only on validating and evaluating the reports generated by the JoinSTNassistant Portal for the strategic-level decision makers of the HCFs, in terms of the following:

i. Validating these reports to determine whether they meet actual needs, requirements, and specifications of the strategic-level decision makers of the HCFs within the KSA, as identified and shown in Chapter 6 (Table 6.1), for assisting and guiding their decision to join the STN.
ii. Evaluating these reports to determine whether they are useful and of sufficient value to the strategic-level decision makers of the HCFs within the KSA for assisting and guiding their decision to join the STN.

This type and scope of evaluation and validation are in line with type and scope of evaluation and validation identified by prior studies such as Cronholm and Goldkuhl (2003) as well as Scriven (1996). Cronholm and Goldkuhl (2003) have argued that this type and scope of validation and evaluation are known as the criteria-based evaluation and validation, to evaluate and validate a given ICT systems “as such”.

This type and scope is used to evaluate and validate only the output of a given ICT system, based on predefined requirements and criteria. Thus, this scope of evaluation and validation does not require any involvement from its potential users (Cronholm & Goldkuhl, 2003). However, the potential consumers of the output of a given ICT system are recommended to be involved and act as the evaluators (Scriven, 1996; Cronholm & Goldkuhl, 2003).

7.3 Selected Criteria for Validation and Evaluation

Researchers such as Scriven (1996), Patton (1990) and Son (2005) have discussed a variety of criteria identified by several researchers for validating and evaluating different types of ICT applications/tools/systems. However, not all of these criteria

are compatible with either all types and scopes of validation and evaluation, or with all types of ICT applications/tools/systems that will be evaluated and validated (Son, 2005; Patton, 1990). Based on these two elements, suitable criteria should be selected (Son, 2005; Patton, 1990). Therefore, based on the type and scope of this validation and evaluation study, discussed and identified in Section 7.2, the selected criteria for this validation and evaluation study as well as their descriptions and sources are listed in Table 7.1.

Table 7.1 Selected Criteria for Validation and Evaluation

Criteria		Descriptions	Sources
Validation	**Compatibility**	The degree to which the information provided/displayed by the reports is compatible with actual needs, requirements, and specifications of the strategic-level decision makers of the HCFs within the KSA, as identified and shown in Chapter 6 (Table 6.1).	(Patton, 1990; Gruhn, 1991; Nazareth, 1989)
	Accuracy	The degree to which the information provided/displayed by the reports is accurate based on the input information entered by the relevant operational-level teams of the HCF.	(Patton, 1990; Gruhn, 1991; Nielsen, 1999)
	Clarity	The degree to which the information provided/displayed by the reports is clear and understandable, in terms of its language, flow/hierarchy, and format.	
	Legibility	The degree to which the information provided/displayed by the reports is easy to be read and to be distinguished accurately.	(Son, 2005; Patton, 1990)
Evaluation	**Usefulness**	The degree to which the information provided/displayed by the reports is useful to the strategic-level decision makers of the HCFs within the KSA for assisting and guiding their decision to join the STN.	(Patton, 1990; Gruhn, 1991; Nazareth, 1989; Nielsen, 1999)
	Sufficiency	The degree to which the information provided/displayed by the reports is of sufficient value to the strategic-level decision makers of the HCFs within the KSA for assisting and guiding their decision to join the STN.	

7.4 Methodology of Validation and Evaluation

7.4.1 Selection procedure and eligibility criteria of participants

Yin (2013) has argued that the use of 3-7 different findings gathered from diverse case studies or focus groups would generate sufficient and efficient evidence and be widely acceptable for any validation and evaluation study. Therefore, the interview was conducted with three different focus groups. Table 7.2 illustrates these three different focus groups against the eligibility criteria of their members (participants).

As shown in Table 7.2, the first focus group's members will act as internal evaluators, since they were involved and interviewed in the Second Phase of the development of

the JoinSTNassistant Framework and its Portal, as discussed in Chapters 4 and 6. Consequently, they were involved in identifying the needs, requirements, and specifications of the strategic-level members of the HCFs that have been incorporated/considered into the reports generated by the JoinSTNassistant Portal, as identified and shown in Chapter 6 (Table 6.1).

Table 7.2 The 3 Focus Groups Against the Eligibility Criteria of their Members (Participants)

Selection procedure and eligibility criteria of participants	Focus group's code		
	FG1	FG2	FG3
Be willing to participate in this survey.	✓	✓	✓
Belong to the strategic level (i.e., working at the top echelons of HCFs) and can influence or participate in the decision-making process of his/her HCF regarding the decision of joining the STN.	✓	✓	✓
Belong to one HCF, and there is no other participant belonging to the same one.	✓	✓	✓
Have knowledge and experience about any complex ICT system and its implementation.	✓	✓	✓
Have knowledge and experience about telemedicine and its implementation.	✓	✓	
One of the 81 strategic-level participants interviewed in the Second Phase.	✓		

The role of the first focus group's members is to provide subjectively to the evaluation and validation process "first pair of eyes" (Mathison, 1991, 1999). Whilst, the second focus group's members will act as external on-field expert evaluators, since they have knowledge and experience about telemedicine and its implementation, but they did not get involved (interviewed) in the Second Phase of the development of the JoinSTNassistant Framework and its Portal. Consequently, their main role is to provide objectively to the process of evaluation and validation "second pair of eyes" (Mathison, 1991, 1999).

Finally, the third focus group's members will act as external out-field expert evaluators, since, although they have knowledge and experience about complex ICT systems and their implementation, they do not have knowledge and experience about telemedicine and its implementation. Their main role is to provide additional evaluations, validations, and "out of the box" suggestions (e.g., aspects, ideas, etc.), which could help to improve the JoinSTNassistant Framework and its Portal.

A list of candidates for the three-different focus group was provided by the STN agency and by the National eHealth Strategy and Change Management Office in the MOH. A research information document, containing a brief introduction about the research, its purpose, and the reasons for the interview, was emailed to all candidates, in order to invite potential participants.

Fourteen (n=14) candidates matched the eligibility criteria of one of three-different focus groups and agreed to participate in this study. In order to provide anonymity and ensure confidentiality, the 14 participants are identified by code. The occupational positions of the 14 participants, and their corresponding codes, as well as their HCFs' categories, are outlined in Table 7.3. An introductory email was sent to all 14 potential participants. This email contained a brief introduction about this study and its aims, and a consent and non-disclosure forms to be signed by them before the interviews.

Table 7.3 Participants' Occupational Position, Code, and Focus Group Code

Focus group's code	Participant's Code	Participant's position / job title	# of participants
FG1	FG1-P01	Director of eHealth Dept.	**6**
	FG1-P02	HIT manager	
	FG1-P03	Head of Quality Management Department	
	FG1-P04	Assistant Hospital Director for HIT Services	
	FG1-P05	Chief Operating Officer	
	FG1-P06	Chief Financial Officer	
FG2	FG2-P07	Director of ICT Department	**5**
	FG2-P08	IT Acting Director	
	FG2-P09	Chief Information Officer	
	FG2-P10	Assistant Hospital Director for HIT Services	
	FG2-P11	HIT manager	
FG3	FG4-P12	Director of ICT Department	**3**
	FG4-P13	Financial Officer	
	FG4-P14	Healthcare Policy Maker	

7.4.2 Validation and evaluation approach

This validation and evaluation study was conducted in the form of semi-structured interview with closed-ended statements and open-ended questions. These statements and questions were developed and determined in advance for guiding the discussions and ensuring that all the selected criteria for this validation and evaluation study have been covered and that the required information/feedback has been elicited from the participants during the interview (Patton, 2015; DiCicco & Crabtree, 2006). These closed-ended statements and open-ended questions, as follow:

i. The predetermined closed-end statements

These statements were developed and determined based on the selected criteria for this validation and evaluation study, as discussed in Section 7.3 and listed in Table 7.1. Table 7.4 shows the predetermined closed-ended statements of the interview. Each statement in this part is linked to one of the selected criteria for this validation and evaluation study, as discussed in Section 7.3 and shown in Table 7.1.

The 14 participants (evaluators) were asked to validate and evaluate the JoinSTNassistant Portal by indicating their opinions/ judgements regarding each

statement by rating it on a scale of 1-10, with 1 being the strongest disagree and 10 being the strongest agree. The scale of 1-10 was chosen based on a recommendation from the statisticians of the Researches and Studies General Department of the MOH. They stated that this scale of 1-10 is the standard scale in the MOH and HCFs within the KSA, and they commonly use it for any evaluation and validation study.

Table 7.4 Predetermined Closed-Ended Statements of the Validation and Evaluation interview

Statement	**On a scale of 1-10, with 1 being the strongest disagree and 10 being the strongest agree, please rate each statement.**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
The information provided/displayed by the reports is compatible with actual needs, requirements, and specifications of the strategic-level decision makers of the HCFs within the KSA, as identified and shown in the leaflets provided in the interview.										
The information provided/displayed by the reports is accurate based on the input information entered by the relevant operational-level teams of the HCF.										
The information provided/displayed by the reports is clear and understandable, in terms of its language, flow/hierarchy, and format.										
The information provided/displayed by the reports is easy to be read and to be distinguished accurately.										
The information provided/displayed by the reports is useful to the strategic-level decision makers of the HCFs within the KSA for assisting and guiding their decision to join the STN.										
The information provided/displayed by the reports is of sufficient value to the strategic-level decision makers of the HCFs within the KSA for assisting and guiding their decision to join the STN.										

ii. The predetermined open-ended questions

These questions were aimed at obtaining additional evaluations, validations, and suggestions (e.g., aspects, ideas, etc.), which could help to improve the JoinSTNassistant Framework and its Portal. They comprised the following two questions:

- Based upon your knowledge and experience, are there any other key features or critical components that should be incorporated/considered into the JoinSTNassistant Framework, its web-based application, or its reports?
- Are there any other aspects/suggestions that you would like to be discussed?

Furthermore, based on the participants' responses, additional appropriate open-ended questions were also asked within the interview, to gain in-depth understanding, or to permit other important aspects to emerge from the participants.

7.4.3 Design of validation and evaluation interview

The interview was designed to be consisted of the following three sessions:

i. A pre-interview presentation session

At the beginning of the interview, a pre-interview presentation was provided to the 14 participants (evaluators). This presentation aimed at informing them about the following topics/subjects:

- The main concepts of telemedicine and facts regarding its future,
- A summary of the STN project, its roadmap, and the challenges and barriers to its implementation,
- A summary of the JoinSTNassistant Framework and its web-based application (portal),
- The reports generated by the JoinSTNassistant Portal for the strategic-level decision makers of the HCFs,
- The needs, requirements, and specifications of the 81 strategic-level members of the STN-CoP, as identified and shown in Chapter 6 (Table 6.1), that have been incorporated/considered into the reports.
- The aims of the interview,
- The guidelines for the interview' questions.

Furthermore, leaflets were also provided to the 14 participants (evaluators), which contained more details about the topics/subjects discussed in the presentations.

ii. A demonstration session

During the demonstration session, the JoinSTNassistant Portal was utilised and operated to be practically illustrated, showing how the portal works and how it generates the reports. This enabled it to be validated and evaluated by the 14 participants, based on the selected and identified criteria, as shown in Table 7.1.

In this session, two different scenarios/cases for two different HCFs (HCF1, HCF2) were applied via the JoinSTNassistant Portal. The first scenario was for HCF1, where all its barriers and all their required tasks are available/resolved. Thus, the reports generated by the JoinSTNassistant Portal for the strategic-level

decision makers of HCF1 should show green (▲) colour code for all barriers and all their required tasks, as shown in Chapter 6 (Figure 6.9).

The second scenario was for HCF2, where all its barriers and all their required tasks either could **Not** be resolved by the HCF2 or they suffer minor challenge(s) that could be resolved by the HCF2. Thus, as shown in Chapter 6 (Figure 6.10), the reports generated by the JoinSTNassistant Portal for the strategic-level decision makers of HCF1 should show the following:

- Yellow (⬣) colour code for those barriers and their required tasks of the HCF2 that suffer minor challenge(s) that could be resolved by the HCF2.
- Red (▼) colour code for those barriers and their required tasks of the HCF2 that could **Not** be resolved by the HCF2.

Furthermore, these reports of both scenarios (HCF1, HCF2) should present only the information that is needed and required by the strategic-level decision makers of the HCFs, as discussed and shown in Chapter 6 (Table 6.1).

iii. Discussion and gathering feedback session

This session began after completing the demonstration session. The participants (evaluators) were asked in this session to validate and evaluate the JoinSTNassistant Portal by filling up the feedback sheet which included the predetermined closed-ended questions of the validation and evaluation interview, as shown in Table 7.4. Afterwards, the two predetermined open-ended questions of the interview, as identified in Section 7.4.1, were asked and discussed with the participants. Furthermore, based on the participants' responses, additional appropriate open-ended questions were also asked within an interview, to gain in-depth understanding, or to permit other important aspects to emerge from the participants.

7.4.4 Data analysis approach

The predetermined closed-ended statements of the validation and evaluation interview were developed and designed to gather data from the 14 participants in numerical and statistical form, which can be put into categories, or in rank order, or measured in units of measurement (Creswell, 2013). Conversely, the predetermined open-ended questions were developed and design to gather qualitative data from the 14

participants, which can be analysed to gain in-depth and better understanding, or to find other important aspects/facts emerged from the participants (Creswell, 2013). Thus, a mixed-method (qualitative and quantitative) approach was used in the data analysis of this validation and evaluation interview. The quantitative method was used in the data analysis of the predetermined closed-ended statements, whereas the qualitative method was used in the data analysis of the predetermined open-ended questions.

7.5 Findings and Discussion

Table 7.5 illustrates the rate (on a scale of 1-10) given by the 14 participants (evaluators) for each one of the selected criteria of this validation and evaluation study.

Table 7.5 Rate Given by Participants (Evaluators) for Selected Criteria of this Validation and Evaluation Study

Focus group's code	Participant's Code	The selected criteria for validation and evaluation					
		Compatibility	Accuracy	Clarity	Legibility	Usefulness	Sufficiency
FG1	FG1-P01	10	10	10	9	10	10
	FG1-P02	10	10	9	9	9	10
	FG1-P03	10	10	8	8	10	10
	FG1-P04	10	10	10	10	9	10
	FG1-P05	10	10	9	9	10	10
	FG1-P06	10	10	8	8	10	10
	Mean (average)	**10**	**10**	**9**	**8.8**	**9.7**	**10**
FG2	FG2-P07	10	10	9	10	9	9
	FG2-P08	9	10	9	8	10	9
	FG2-P09	10	9	10	8	10	9
	FG2-P10	10	10	8	9	9	9
	FG2-P11	9	10	10	8	9	10
	Mean (average)	**9.6**	**9.8**	**9.2**	**8.6**	**9.4**	**9.2**
FG3	FG4-P12	10	10	9	7	9	8
	FG4-P13	9	10	9	8	9	9
	FG4-P14	10	10	8	8	10	10
	Mean (average)	**9.7**	**10**	**8.7**	**7.7**	**9.3**	**9.0**
Total mean (average)		**9.8**	**9.9**	**9.0**	**8.5**	**9.5**	**9.5**

As shown in this table, the lowest rate given by any participant is 7 out of 10, with 1 being the strongest disagree and 10 being the strongest agree. Furthermore, the highest rate given by any participant is 10 out of 10.

In addition, as shown in Table 7.5 and Figure 7.1, the lowest average rate of the focus group is 7.7 out of 10, which was given by the participants of the FG3 focus group for the legibility criterion.

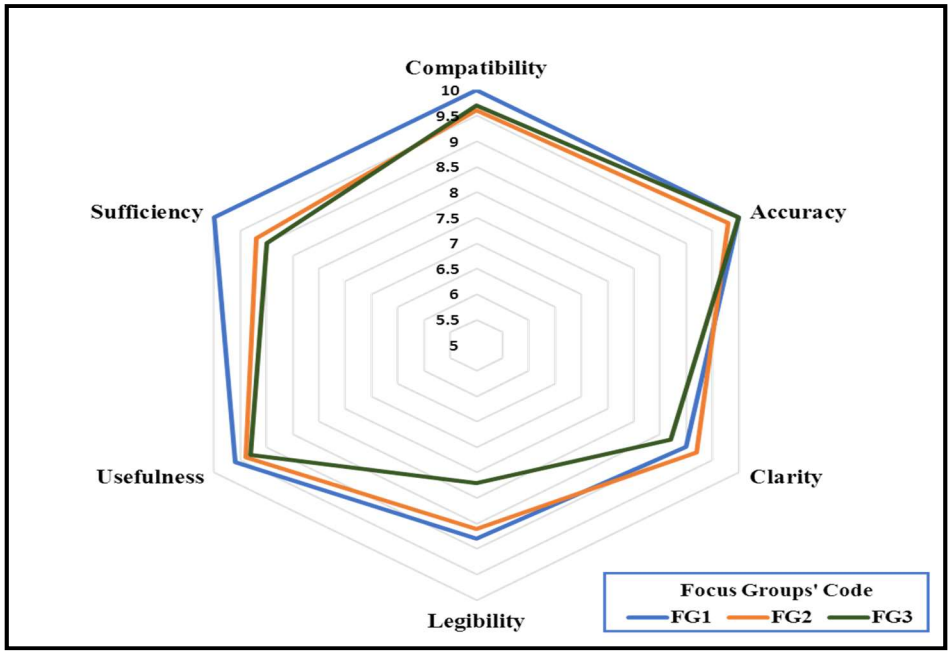

Figure 7.1 Rate of Selected Criteria of this Validation and Evaluation Study based on the focus groups

The accuracy criterion has received the highest rate given by all participants (9.9 out of 10). All the participants strongly agreed that the information provided/displayed by the reports is accurate based on the input information entered by the relevant operational-level teams of the HCF.

In terms of the compatibility criterion, as shown in Table 7.5 and Figure 7.1, this criterion has received an average rate of 9.8 out of 10 from all participants. This criterion has received average rate 10, 9.6, and 9.7 out of 10 from FG1, FG2, and FG3, respectively. This finding reflects the fact that all participants strongly agreed that the information provided/displayed by the reports is compatible with actual needs, requirements, and specifications of the strategic-level decision makers of the HCFs within the KSA.

The participants agreed that the information provided/displayed by the reports is easy to be read and to be distinguished accurately, as well as being clear and understandable, in terms of its language, flow/hierarchy, and format. This is because, as shown in Table 7.5 and Figure 7.1, the clarity and legibility criteria have achieved respectively average rates of 9 and 8.5 out of 10 from all participants.

In terms of usefulness and sufficiency criteria, the findings of the interview, as shown in Table 7.5, show that both the usefulness and the sufficiency criteria have reached an average rate of 9.5 out of 10 from all participants. These findings reflect the fact that the participants strongly agreed that the information provided/displayed by the reports is useful and of sufficient value to the strategic-level decision makers of the HCFs within the KSA for assisting and guiding their decision to join the STN.

These findings reflect the fact that there is a high percentage of acceptance and satisfaction between all the participants involved in the interview regarding the JoinSTNassistant Framework, its web-based application (Portal), and its reports. The participants gave high rates for all the selected criteria of this validation and evaluation study, since the lowest average rate given by all participants for these selected criteria was 8.5 out of 10 for the legibility criterion.

These findings (i.e., the high percentage of acceptance and satisfaction between all the participants) were expected because of the following facts:

- Firstly, as discussed in Chapter 4 and 5, the JoinSTNassistant Framework was developed in involvement with their potential users. This involvement was as follows:
  - They were involved in the Second Phase of the development of the JoinSTNassistant, as discussed in Chapter 4. In this Phase, 81 strategic-level Expert Members of the STN-Communities of Practice (STN-CoP), representing all the 22-diverse categories of HCFs within the KSA were interviewed. They discussed the Initial Version of the JoinSTNassistant Framework. Accordingly, the Initial Version was revised and updated based on their feedback, and is referred to as the "Developed Version of the JoinSTNassistant Framework", as shown in Chapter 4 (Figure .(4.3
  - They were also involved in the Third Phase of the development of the JoinSTNassistant, as discussed in Chapter 5. In this Phase, as many as 905 potential users, forming a representative sample size of the decision makers of all HCFs across the KSA, responded to a specially designed questionnaire. Accordingly, the Developed Version of JoinSTNassistant Framework has been further revised and updated to incorporate their responses, and it will now be referred to as the "Final Version of the JoinSTNassistant Framework", as shown in Chapter 5 (Figure 5.3).

- Secondly, as discussed in Chapter 6, the JoinSTNassistant Portal and its reports were developed with involvement of potential users. This involvement was ensured by discussions with the 81 strategic-level decision makers of KSA's HCFs interviewed in the Second Phase, regarding their requirements and specifications of information needed to decide to join the STN. Accordingly, the JoinSTNassistant Portal and its reports have been designed to provide and present specific information in a specific manner/format based on the needs, requirements, and specifications of the 81 strategic-level members of the STN-CoP, as identified and shown in Chapter 6 (Table 6.1).
- Thirdly and finally, during the development (programming) stage of the JoinSTNassistant Portal and its reports, which lasted nearly eight months, numerous testing and debugging phases were applied in collaboration with programmers and quality assurance specialists of the MOH and of the STN agency. Consequently, several versions of the Portal were updated until the last version (version 2.4) was deployed (i.e., accepted to be adopted) after passing the quality assurance testing.

As mentioned and discussed in Section 7.4.1, two predetermined open-ended questions were asked and discussed by the participants. These questions were aimed at obtaining additional evaluations, validations, and suggestions (e.g., key features, aspects, ideas, etc.) to improve the JoinSTNassistant Framework and its Portal. Generally, the feedback obtained from participants (evaluators) was very encouraging and supportive. The 14 participants agreed that the JoinSTNassistant Framework, its Portal, and generated reports provide a comprehensive and structured procedure to assist HCFs across the KSA regarding their decision to join the STN in a scientific, effective, sensible, and realistic way. They further stated that this Framework, its Portal, and generated reports are relevant specifically to the context and the needs of the KSA, its HCFs, and the STN roadmap.

However, several suggestions obtained from participants (evaluators), did not ask for any revision or modification, but for enhancing the design of the user interface screen of the JoinSTNassistant Portal and/or its generated reports. For instance, one of the participants suggested to add Arabic language to the user interface screen of the JoinSTNassistant Portal and its reports. This suggestion, besides another suggestion obtained will be discussed and considered in the future work in Chapter 8.

7.6 Conclusions

This chapter discussed the validation and evaluation of the JoinSTNassistant Portal. The validation was intended to assess whether the Portal has met fully its design specifications. The evaluation was to examine if and to what extent it met the requirements of its intended users, so that the KSA HCFs intending to join the STN would use it extensively.

In our case the two tests were strongly related and it was decided to conduct them with three focus groups, composed of senior managers with relevant experience, who, not only were potential users, but also, in most cases, have been involved in the development phases of the Framework and of the Portal.

The results were fully positive, with mean averages between 8.5 and 9.9 out of 10, as shown in Table 7.5. These encouraging results were a welcome confirmation of the methodology adopted for this research, which was based on the extensive and continued involvement of the potential users (i.e., strategic-level decision makers of the HCFs within the KSA) throughout the development of the Framework and of the Portal.

Finally, and even more important, these results indicate that this Framework and Portal can be confidently expected to be used appropriately by the HCFs of all 22 KSA Categories. Having validated and evaluated the framework and portal, the next chapter presents final conclusions and suggestions for future work.

Chapter 8: Conclusions and Future work

8.1 Introduction

This chapter concludes this PhD research and recommends areas for future research. It also presents the limitations of this PhD research. This chapter begins with the summary of the research completed (Section 8.2), followed by highlighting its novel contributions to knowledge in Section 8.3.

Section 8.4 discusses and outlines the limitations of this PhD research, while Section 8.5 highlights challenges faced on this PhD journey. The final section (Section 8.6) discusses and outlines the further work.

8.2 Research Summary

As highlighted and discussed in Chapter 1 (Section 1.1), the KSA's healthcare system is experiencing difficulties, and the MOH is under tremendous pressure from the KSA government, regarding the improving of access to healthcare services and providing high-quality healthcare services to all residents, especially in remote and rural areas. In 2011, the MOH expressed strong support for telemedicine and launched the STN, as the first National Project for telemedicine within the KSA's healthcare system, which is planned to be completed by 2020 (Canada Health Infoway, 2013). The MOH relies on the STN to alleviate many difficult challenges that prevent the improvement of the KSA's healthcare system (Canada Health Infoway, 2013). Despite the potential benefits of the STN, they will only be realised through its successful implementation within the KSA's healthcare system (i.e., within the HCFs across the KSA). Approximately 75% of the implementation projects of telemedicine are abandoned or 'failed outright' worldwide, and this percentage has reached 90% in developing countries (van Dyk & Schutte, 2013; Nauta et al., 2015; Kaplan & Harris-Salamone, 2009; Zailani et al., 2014; Healy, 2008). Furthermore, roughly 80% of the implementation projects of such complex ICT systems within the KSA's healthcare system are failed projects, in spite of the KSA government commitments, funding, and support (Abouzahra, 2011). These dramatic statistics, and the historical pains of losing time and cost, resulting from the failure of implementing such complex ICT systems within the KSA's healthcare system, led the MOH to initiate and recognise the need to involve researchers in the STN implementation project, in order to increase the likelihood of its successful implementation.

Hence, we were invited by the MOH and the STN agency to be involved in the STN implementation project and this PhD research has been agreed to be a part of the STN project, and is based on the STN roadmap. Consequently, the motivation of this research is to contribute to the facilitation of the STN implementation process, and to increase the likelihood of its successful implementation by identifying gaps and challenges that could be addressed and resolved.

Therefore, the scope of this PhD research has been identified as to be restricted to find or develop an applicable framework for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN, as discussed and highlighted in Chapter 1 (Section 1.2).

The literature review reveals that there is a limited number of existing organisational decision-making frameworks/models for assisting the implementation of telemedicine system in HCFs within any countries/organisations. We argue that the existing frameworks/models, which are described and discussed in Chapter 2 (Section 2.6), are generic and limited in their applicability. Therefore, we argue that they are neither suitable nor effective for assisting and guiding the strategic-level decision makers of HCFs across KSA regarding their organisational decision to join the STN. In addition, we argue that, to the best of our knowledge, there is not any existing organisational decision-making framework/model that has been specifically developed for this purpose.

Thus, we state that this PhD research is not intended to develop a rival to existing frameworks, but its main aim is to develop a novel framework, referred to as "JoinSTNassistant Framework", to bridge this gap. It must be ensured that this framework is theoretically rigorous, as well as relevant specifically to the context and the needs of the KSA, its HCFs, and the STN roadmap.

The main research question for this study can be expressed as follows

> *How to develop the JoinSTNassistant Framework that can assist and guide the strategic-level decision makers of HCFs across KSA regarding their organisational decision to join the STN?*

As highlighted and discussed in Chapter 1 (Section 1.5), this PhD research adopts the Pragmatism philosophy. Accordingly, the triangulation technique of the mixed-methods (i.e., qualitative and quantitative) approach has been applied in this PhD research, as discussed in Chapter 1 (Section 1.6). This is because this technique provides more credibility and reliability to the research and to its findings, which could

convince the pragmatists (Morgan, 2007; Scott & Briggs, 2009). Consequently, as shown in Chapter 1 (Figure 1.2), the final findings of this PhD research (the JoinSTNassistant Framework) has been developed through three-sequential phases as follows:

I. The First Phase of the development of JoinSTNassistant Framework

This Phase is discussed and presented in detail in Chapter 3. It defines and applies the theoretical and philosophical foundations of the JoinSTNassistant Framework. In this First Phase, 56-selected studies from the extensive literature review were analysed, and the final outcome identified 5 pillars and their 17-relvent barriers. Those form/compose the Initial Version of the JoinSTNassistant Framework. The following three points support the reliability of these findings:

i. The vast literature review performed, resulting in the selection of 56 relevant studies based on 6 inclusion criteria, discussed and highlighted in Chapter 3 (Section 3.4.1).
ii. The sound theoretical foundation provided by the chosen theoretical framework (TOE).
iii. The rigorous and most comprehensive methodology adopted. This was the Braun and Clarke (2006) six step qualitative thematic approach, which involved both inductive (steps 1 to 3) and deductive (steps 4 to 6) analysis.

All the pillars and barriers are discussed in detail in Chapter 3 (Section 3.5). This showed how the 17 barriers affected implementations of this kind on a global scale, but particularly in the KSA, the Middle East, developing countries, and rural or peripheral areas everywhere.

II. The Second Phase of the development of JoinSTNassistant Framework

Many seemingly attractive and theoretically sound new frameworks have failed to achieve their goals and disappeared without trace because they were not applicable for the people for whom they had been developed. In other words, they had been developed without gaining the understanding of their potential users. Therefore, **the Second Phase** of the development of the JoinSTNassistant Framework, which is discussed and presented in detail in Chapter 4, was planned to address this issue, and reflects the practical and pragmatic requirements of the JoinSTNassistant Framework. This was achieved by carefully planned but open-ended interviews, conducted with 81

strategic-level expert members of the STN-CoP, representing all the 22-diverse categories of HCFs within the KSA. These 81participants were chosen based on eligibility criteria discussed and presented in Chapter 4 (Section 4.2.1).

The interviews aimed at the following points:

i. Discussing and evaluating the Initial Version of the JoinSTNassistant Framework produced by the First Phase and revising it accordingly. As discussed and presented in Chapter 4, the findings of the discussion demonstrated that there is no consensus among all the 22-diverse HCFs' categories, regarding the significant influential strategic-level barriers to their decision to join the STN. Almost each one of them has its own unique subset of the 17 barriers of the Initial Version of the JoinSTNassistant Framework. Thus, this Framework could not and should not be a one-size-fits-all framework, applicable and used by all the 22-diverse HCFs within the KSA for assisting their decision to join the STN. Therefore, based on the findings of the interviews, the Initial Version of the JoinSTNassistant Framework was revised and developed into a technique that could enable it to be modified and adjusted to be applicable for all the 22-diverse categories of the HCFs within the KSA. This involved distinguishing between barriers common to all HCFs categories and barriers specific to HCFs categories, as discussed in Chapter 4. The revised vision of the JoinSTNassistant Framework produced by the Second Phase is referred to as "the Developed Version of the JoinSTNassistant Framework", as shown in Chapter 4 (Figure .(4.3

ii. Discussing the normal decision-making process of HCFs across the KSA, and the types of information that are usually required, for the purpose of reaching a consensus for determining the following:
    a. A suitable decision-assist technique(s) to be utilised by the JoinSTNassistant Framework.
    b. Key features that should be incorporated/considered into the JoinSTNassistant Framework.
    c. A measurable and tangible parameter for each important influential barrier.

As discussed and presented in Chapter 6 (Section 6.2), the 81 strategic-level participants of the interviews stated that the decision-making process of

their HCFs will not be aimed at deciding whether or not joining the STN. However, it will be aimed at identifying and evaluating the proceedings and tasks that should be accomplished by the HCFs to join the STN successfully. Consequently, as shown in Chapter 6 (Figure 6.1), the findings of the discussion show that the decision-making process of the HCFs to join the STN will consist of two main stages (pre-decision and decision stages). These two-main stages reflect the fact that the HCFs' decision-making process to join the STN will be a structured and data-driven decision-making process. It will consist of interactions between the information gathered by the operational-level teams of the HCFs and the evaluations and perspectives of the strategic-level decision makers of the HCFs regarding this gathered information. Therefore, the JoinSTNassistant Framework utilises the checklist decision-assist technique, as it is suitable for assisting the decision makers to find and evaluate the information needed for making a decision (Pullin et al., 2004; Vennix et al., 1992; Zhou et al., 2008). Further details about this technique and the checklist templates generated by the JoinSTNassistant Framework are presented in Chapter 6 (Section 6.2 and 6.3).

III. The Third Phase of the development of JoinSTNassistant Framework

It was considered vitally important to involve as many potential users as possible in the development of the JoinSTNassistant Framework, so as to ensure that it reflected their expectations and met their needs. Although this involvement was ensured by the Second Phase of development, the **Third Phase** of the development, covered in Chapter 5, has been developed to involve as many as 905 potential users, forming a representative sample size of the decision makers of all HCFs across the KSA. They returned a specially designed questionnaire, and a quantitative method approach was used in analysing their answers. The Developed Version of JoinSTNassistant Framework has been further revised and updated to incorporate the findings of this Third Phase, and is referred to as the "Final Version of the JoinSTNassistant Framework", as shown in Chapter 5 (Figure 5.3).

The findings of the Third Phase have complemented, supported, validated, and proved the findings of the Second Phase, as well as our argumentation and discussion. They have supported, validated, and proved that there is no consensus among all the 22-diverse HCFs' categories, regarding the significant influential strategic-level barriers

to their decision to join the STN. Thus, this Framework could not and should not be considered as a one-size-fits-all framework, applicable and used as a monolithic entity by all the 22-diverse HCFs categories. However, the methodology adopted and its three-phase implementation, have achieved an **articulated "Final Version Framework"** from which HCFs of any of the 22 categories can easily extract and use the well-defined subset that a representative sample of managerial staff of their own category has considered and approved as responding to the characteristics and needs of their category. This Final Version Framework, therefore, while it does not fit-all-sizes, should fit the sizes of all the HCFs within the KSA for assisting their decision to join the STN.

- ***The development of JoinSTNassistant Portal***

After achieving the Final Version of the JoinSTNassistant Framework, its web-based application (i.e., portal) was developed, referred to as "JoinSTNassistant Portal". This Portal was developed to provide a powerful and user-friendly tool for enabling the JoinSTNassistant Framework to be accessible and used by each HCF for assisting and guiding its decision to join the STN. The main aim of this Portal is to overcome the issue of the vast different characteristics and requirements of HCFs within the KSA. As shown in Figure *8.1*, these differences have been determined and incorporated in the Framework and in its Portal in an articulated, flexible way that allows the Portal to:

i. Modify and adjust the JoinSTNassistant Framework in order to make it applicable for each HCF within the KSA by selecting, extracting, and providing the well-defined and specific subset of the barriers of the JoinSTNassistant Framework that a representative sample of managerial staff of their own category has considered and approved as responding to the characteristics and needs of their category.
ii. Generate a report for the strategic-level decision makers. These reports are designed to provide and present specific information in a specific manner/format, based on the needs, requirements, and specifications of the 81 strategic-level members of the STN-CoP identified and shown in Chapter 6 (Table 6.1).

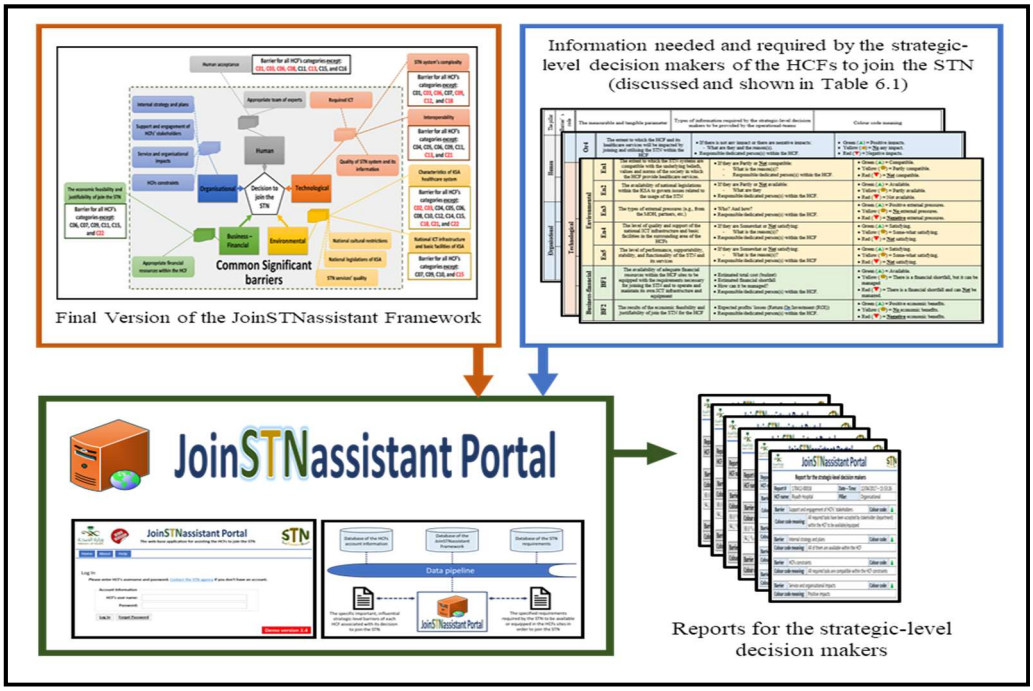

Figure 8.1Main Aim of the JoinSTNassistant Portal

After developing the JoinSTNassistant Portal, it was validated and evaluated by three different focus groups, as discussed and outlined in Chapter 7. The first focus group's members act as internal evaluators, since they were involved and interviewed in the Second Phase of the development of the JoinSTNassistant Framework and its Portal. The role of the first focus group's members is to provide subjectively to the evaluation and validation process as "first pair of eyes" (Mathison, 1991, 1999). Whilst, the second focus group's members act as external on-field expert evaluators, since they have knowledge and experience about telemedicine and its implementation, but they did not get involved (interviewed) in the Second Phase of the development of the JoinSTNassistant Framework and its Portal. Consequently, their main role is to provide objectively to the process of evaluation and validation as "second pair of eyes" (Mathison, 1991, 1999). Finally, the third focus group's members act as external out-field expert evaluators, since, although they have knowledge and experience about complex ICT systems and their implementation, they do not have knowledge and experience about telemedicine and its implementation. Their main role is to provide additional evaluations, validations, and "out of the box" suggestions (e.g., aspects, ideas, etc.), which could help to improve the JoinSTNassistant Framework and its Portal.

The validation was intended to prove that the Portal met fully its design specifications, while the evaluation was to prove if and to what extent the Portal met the requirements

of its intended users, so that the KSA HCFs intending to join the STN would use it extensively. The results were fully positive, with mean averages, out of 10, between 8.5 and 9.9, as shown Chapter 7 (Table 7.5).

These excellent results were a welcome confirmation of the methodology adopted for this research, based on the extensive and continued involvement of the potential users throughout the development of the Framework and of the Portal. Finally, and even more important, these results indicate that this Framework and Portal can be confidently expected to be used extensively by the HCFs of all 22 KSA Categories.

8.3 Novel Contributions to Knowledge

The core novel contribution of this PhD research is the development of the JoinSTNassistant Framework for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN. The JoinSTNassistant Framework is a novel, holistic, and agile framework because of the following:

i. It is a novel framework in terms of its scope and its context, since it is developed to be appropriate to the context and the needs of the KSA, its HCFs, and the STN roadmap. As discussed and outlined in Chapter 2 (Section 2.6), the existing frameworks/models are neither suitable nor effective for assisting and guiding the strategic-level decision makers of HCFs across KSA regarding their decision to join the STN. In addition, we argue that, to the best of our knowledge, there is not any existing framework that has been specifically developed for this purpose.

ii. It is a holistic framework in terms of the following three points:
    - Firstly, its applicability for all the HCFs within the KSA, for assisting their decision to join the STN, as discussed and highlighted in Chapter 4 (Section 4.4).
    - Secondly, covering the important predictive pillars within the scope of this research, and those acting as influential pillars of the HCFs across the KSA regarding their organisational decision to join the STN.
    - Thirdly, containing the relevant important predictive organisational-level barriers that are appropriate to the context and the needs of the KSA, its HCFs, and the STN roadmap. These

barriers are also expected to act as influential barriers, with respect to the decision of HCFs across the KSA to join the STN, fully within the scope of this research.

iii. It is an agile framework, in terms of developing a technique that could be modified and adjusted to be applicable for all HCFs within the KSA.

Other novel contributions of this PhD research are listed below:

i. Identifying the important predictive pillars and their relevant important predictive organisational-level barriers that are expected to act as influential barriers, with respect to the decision of HCFs across the KSA to join the STN. This is fully within the scope of this research. As discussed and highlighted in Chapter 3 (Section 3.3 and 3.4), we argue that, to the best of our knowledge, no comprehensive scientific study has investigated these pillars and their relevant barriers in HCFs across the KSA and at a national level. This PhD research has investigated and identified them, as discussed and highlighted in Chapters 3, 4, and 5.

ii. Identifying the perspectives of the strategic-level decision makers of HCFs across the KSA regarding the following points:
    - The decision-making process, and its expected challenges, of the HCFs to join the STN, as discussed and highlighted in Chapter 6 (Section 6.2).
    - The most suitable decision-assist technique for assisting and guiding the HCFs' organisational decision to join the STN, as discussed and highlighted in Chapter 6 (Section 6.2).
    - The most suitable parameter for each barrier of the JoinSTNassistant Framework, so that the barriers become measurable and tangible, for assisting each HCF to manage its progress of resolving its barriers and joining the STN successfully, as discussed and highlighted in Chapter 6 (Section 6.2).
    - The types of information required and needed by the strategic-level decision makers for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN, as discussed and

highlighted in Chapter 6 (Section 6.2) as well as shown in Table 6.1.

iii. Developing a web-based application (i.e., Portal) for the JoinSTNassistant Framework, referred to as "JoinSTNassistant Portal". As discussed and highlighted in Chapter 6, this Portal was developed for modifying and adjusting the JoinSTNassistant Framework in order to be applicable for each one of HCFs across the KSA. Therefore, this Portal will provide a powerful and user-friendly tool for enabling the JoinSTNassistant Framework to be accessible and used by each HCF for assisting and guiding its decision to join the STN. The main aim of this Portal is to overcome the issue of the vast different characteristics and requirements of HCFs within the KSA.

8.4 Limitations

Despite the substantial contributions and implications of this PhD research, it has limitations, some of which are outlined as follows:

- This PhD research restricts the focus of its scope, which is developing an applicable framework for assisting and guiding the strategic-level decision makers of HCFs across KSA, regarding their organisational decision to join the STN.
- Consequently, and fully within the scope of this research, the proposed framework (the JoinSTNassistant Framework) includes the important predictive pillars (i.e., dimensions) and their relevant important predictive organisational-level barriers that are expected to act as influential barriers, with respect to the decision of HCFs across the KSA to join the STN. Therefore, this PhD research does not consider any dimension and barrier out of its scope (e.g., individual-level dimensions and barriers that relate to the role and influence of the characteristics of individual decision makers in the decision of their HCFs to join the STN).
- This PhD research is only limited to the organisational decision of the HCFs across the KSA regarding joining the STN. Consequently, this JoinSTNassistant Framework is relevant specifically to the context characteristics and the needs of the KSA, its HCFs, and the STN roadmap. Therefore, this Framework could not be applied to the implementation of other ICT innovations within the KSA or to the implementation of telemedicine

within other countries. This is because, as discussed and outlined in Chapter 2 (Section 2.6), although most countries are likely to face some common barriers in implementing each ICT innovation, the implementation of each ICT innovation within each country will have its own unique sets of barriers related to many characteristics, with different business drivers, needs, funding incentives (Healy, 2008; Garshnek & Hassell, 1999; Gagnon et al., 2005; Cresswell & Sheikh, 2013; Canada Health Infoway, 2013; Gilson & Raphaely, 2008; Baker, 2012; Bouwman et al., 2005). These characteristics are such as:

i. The characteristics of the country context and environment (e.g., its macro-economic, culture, structure, social and political situation);
ii. The characteristics of the country implementation strategies, and plans for implementing this ICT innovation (e.g., its project plan, project processes);
iii. The characteristics of the ICT innovation that will be implemented, and the availability of requirements for implementing it (e.g., equipment, infrastructure).

In addition, some of the barriers that limited one ICT innovation in a given country, may no longer exist, partly diminish, or become an opportunity for either another ICT innovation or another country (Gilson & Raphaely, 2008; Baker, 2012).

8.5 Challenges

Several challenges were faced while conducting this PhD research, some of which are outlined as follows:

- The main challenge faced in this PhD research was associated with its wide scope. This is because the scope of this PhD research has been identified as to develop an applicable framework for assisting and guiding the strategic-level decision makers of **all** HCFs across KSA, regarding their organisational decision to join the STN. The challenge is that the KSA healthcare system has a complex structure and its current state is such that there are 22-diverse categories of HCFs participating in the KSA healthcare system. Each of them has its own barriers, characteristics and requirements. Consequently, developing the JoinSTNassistant Framework to be applicable for the vast

different characteristics and requirements of all the HCFs within the KSA was one of the main challenges of this PhD research.

- Another challenge faced in this PhD research was associated with the collection of important data for conducting it. As discussed and outlined in Chapter 3 (Section 3.3), the concept of telemedicine implementation, and particularly the organisational-level barriers influencing its implementation decision within HCFs, is considered as almost a new topic or phenomenon in most HCFs across the KSA, which have not implemented and utilised telemedicine before. Furthermore, the STN is the first national project for telemedicine within the KSA, planned to be completed by 2020. Due to these two facts, the search of literature indicated that there is a limited number of studies that have investigated the barriers and challenges related to the implementation of telemedicine within the KSA or any HCFs in its healthcare system. In addition, to the best of our knowledge, no comprehensive scientific study has investigated these organisational-level barriers in all HCFs across KSA, and at a national level. Although this PhD research is in collaboration with the MOH and the STN agency, gaining some important documents and statistical reports about relevant subjects (e.g., the STN or the challenges of its implementation) was very difficult and time-consuming, particularly from the private consultancy organisations collaborating with the MOH and the STN agency.
- Conducting interviews, with as many as 81 participants at one time, makes controlling and managing the interviews' sessions another challenge faced in this PhD research. Several subjects that we discussed in the interviews were not directly related to the interviews' aims. Furthermore, sometimes the discussions were taken over by some participants who challenged each other's speeches and raised irrelevant subjects. In addition, since this PhD research is in collaboration with the MOH and the STN agency, some of the interviewees were commendatory and cautious in their responses, and avoided expressing their negative or dissenting opinion during the interview. In contrast, some of them were responding furiously because of previous positions or repercussions with the MOH. Furthermore, some of the decision makers of HCFs, with the required skills and knowledge, refused to participate in this PhD research for the same reason. Besides, the 81 participants were usually busy and it was hard

to find adequate time and schedule appropriate appointments for the interviews, so that they were conducted on Saturdays (a weekend day).

8.6 Future work

The following points are identified for future work:

- A periodic assessment of the JoinSTNassistant Framework and its barriers, as well as the significant barriers for each category of the 22-diverse HCFs' categories within the KSA, will be performed in order to update and revise the JoinSTNassistant Framework accordingly.
- An area for future research is to extend the scope of this PhD research by:
    - Investigating how the JoinSTNassistant Framework could be extended to be applicable to other ICT innovations (e.g., EHR systems) within the KSA, or to the implementation of telemedicine within other countries, particularly neighbouring countries, which are close to the context characteristics of the KSA.
    - Covering the operational-level's scope, by conducting research to identify barriers and needs of the operational-level teams of the HCFs that could influence the decision of their HCFs to join the STN.
- Further future work will be conducted for enhancing and improving the design of the user interface screen of the JoinSTNassistant Portal and its generated reports. Several suggestions were obtained from the participants (evaluators) of the validation and evaluation study conducted in this PhD research, as discussed in Chapter 7. Two of these suggestions are outlined as follows:
    - Adding Arabic language to the user interface screen of the JoinSTNassistant Portal and its reports.
    - Adding features to the Portal to make it able to prepare and generate project plans, and periodic status reports showing the progress of the HCFs' process of joining the STN.

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Appendices

Appendix A: The approval of the Faculty Research Ethics Committee at Staffordshire University.

RESEARCH ETHICS

Proportionate Review Form

STAFFORDSHIRE UNIVERSITY

The Proportionate Review process may be used where the proposed research raises only minimal ethical risk. This research must: focus on minimally sensitive topics; entail minimal intrusion or disruption to others; and involve participants who would not be considered vulnerable in the context of the research.

PART A: TO BE COMPLETED BY RESEARCHER

Name of Researcher:	Abdulellah Abdullah N. ALABOUDI

Student/Course Details (If Applicable)			
Student ID Number:			12027560
Name of Supervisor(s)/Module Tutor:			Prof. Anthony Atkins and Prof. Bernadette Sharp
PhD/MPhil project:	☒		
Taught Postgraduate Project/Assignment:	☐	Award Title:	MPhil with possible transfer to PhD (Full-Time Study)
Undergraduate Project/Assignment:	☐	Module Title:	

Project Title:	A Holistic Framework for Assessing Tele-medicine Applications in Saudi Arabia (Saudi Tele-medicine Network 'STN')		
Project Outline:	The aim of this research is to develop a holistic framework to support the adoption and development of telemedicine in Kingdom of Saudi Arabia (KSA) by assisting decision makers (stakeholders) of Healthcare Facilities (HCFs) in KSA to evaluate the viability and effectiveness of each of telemedicine applications to be implemented in their HCF.		
Give a brief description of participants and procedure (methods, tests etc.)	Two online questionnaires will be carried out. First questionnaire aiming to investigate opinions of the decision makers of HCFs in KSA to identify the factors that influence the decision making of telemedicine adoption in their HCF in KSA context. The second questionnaire aiming to investigate opinions of human (i.e., clinical staff and citizens of KSA) to identify the factors that influence human acceptance and use of telemedicine in KSA context. For both questionnaires, no specific organisations are involved; individuals are randomly selected; no medical information is elicited. The questionnaire will be sent to about 1000 individuals covering all categories of participants through social networks and personal contact, no inclusion or exclusion criteria. The age will be between over 18 and 60 years old, distributed equally through gender and educational levels. No vulnerable individuals are required to participate.		
Expected Start Date:	07-10-2013	Expected End Date:	07-09-2016

Relevant professional body ethical guidelines should be consulted when completing this form.

Please seek guidance from the Chair of your Faculty Research Ethics Committee if you are uncertain about any ethical issues arising from this application.

There is an obligation on the researcher and supervisor (where applicable) to bring to the attention of the Faculty Ethics Committee any issues with ethical implications not identified by this form.

Proportionate Review

Researcher Declaration

I consider that this project has no significant ethical implications requiring full ethical review by the Faculty Research Ethics Committee.	☒

I confirm that:		
1.	The research will **NOT** involve members of vulnerable groups. Vulnerable groups include but are not limited to: children and young people (under 18 years of age), those with a learning disability or cognitive impairment, patients, people in custody, people engaged in illegal activities (e.g. drug taking), or individuals in a dependent or unequal relationship.	☒
2.	The research will **NOT** involve sensitive topics. Sensitive topics include, but are not limited to: participants' sexual behaviour, their illegal or political behaviour, their experience of violence, their abuse or exploitation, their mental health, their gender or ethnic status. The research must not involve groups where permission of a gatekeeper is normally required for initial access to members, for example, ethnic or cultural groups, native peoples or indigenous communities.	☒
3.	The research will **NOT** deliberately mislead participants in any way.	☒
4.	The research will **NOT** involve access to records of personal or confidential information, including genetic or other biological information, concerning identifiable individuals.	☒
5.	The research will **NOT** induce psychological stress, anxiety or humiliation, cause more than minimal pain, or involve intrusive interventions. This includes, but is not limited to: the administration of drugs or other substances, vigorous physical exercise, or techniques such as hypnotherapy which may cause participants to reveal information which could cause concern, in the course of their everyday life.	☒
6.	The research **WILL** be conducted with participants' full and informed consent at the time the study is carried out: • The main procedure will be explained to participants in advance, so that they are informed about what to expect. ☒ • Participants will be told their involvement in the research is voluntary. ☒ • Written consent will be obtained from participants. *(This is not required for self-completion questionnaires as submission of the completed questionnaire implies consent to participate).* ☒ • Participants will be informed about how they may withdraw from the research at any time and for any reason. ☒ • For questionnaires and interviews: Participants will be given the option of omitting questions they do not want to answer. ☒ • Participants will be told that their data will be treated with full confidentiality and that, if published, every effort will be made to ensure it will not be identifiable as theirs. ☒ • Participants will be given the opportunity to be debriefed i.e. to find out more about the study and its results. ☒	☒ N/A ☐

If you are unable to confirm any of the above statements, please complete a **Full Ethical Review Form**. If the research will include participants that are **patients**, please complete the Independent Peer Review process.

Proportionate Review

Supporting Documentation

All key documents e.g. consent form, information sheet, questionnaire/interview schedule are appended to this application.	☒

Signature of Researcher:		Date:	04/03/2015

NB: If the research departs from the protocol which provides the basis for this proportionate review, then further review will be required and the applicant and supervisor(s) should consider whether or not the proportionate review remains appropriate. If it is no longer appropriate a full ethical review form **MUST** be submitted for consideration by the Faculty Research Ethics Committee.

Next Step:

STUDENTS: Please submit this form (and supporting documentation) for consideration by your Supervisor/ Module Tutor.

STAFF: Please forward this form to the Chair of Faculty Research Ethics Committee who will arrange for it to be considered by an independent member of the Faculty Research Ethics Committee.

PART B: TO BE COMPLETED BY SUPERVISOR/MODULE TUTOR (If Applicable)

I consider that this project has no significant ethical implications requiring full ethical review by the Faculty Research Ethics Committee.	☒
I have checked and approved the key documents required for this proposal (e.g. consent form, information sheet, questionnaire, interview schedule).	☒

Signature of Supervisor:	R S Ethics 	Date:	4/3/2015

Next Step: Please forward this form to the Chair of Faculty Research Ethics Committee who will arrange for it to be considered by an independent member of the Faculty Research Ethics Committee, having no direct connection with the researcher or his/her programme of study.

Proportionate Review

PART C: TO BE COMPLETED BY FACULTY RESEARCH ETHICS COMMITTEE MEMBER

This research proposal has been considered using agreed University Procedures and is now approved. Or This research proposal has not been approved due to the reasons given below.	☑ ☐

Name of Reviewer:	Elhadj Benkhelifa	Date:	04/03/2015
Signature:			

Proportionate Review

Appendix B: The approval of the Regional Research Ethics Committee at MOH.

KINGDOM OF SAUDI ARABIA
MINISTRY OF HEALTH
GENERAL DIRECTORATE OF HEALTH AFFAIRS
AL-QASSEM REGION

المملكة العربية السعودية
وزارة الصحة
المديرية العامة للشئون الصحية بمنطقة القصيم

وزارة الصحة
Ministry of Health

الرقم : ٩٥١٧/٤٤/٥٠ التاريخ : ١٤٣٦/٩/٢٦ المشفوعات :

الموضوع :

Thursday, July 9, 2015

المحترم صورة مع التحية لسعادة / مساعد المدير العام للتخطيط و التدريب

To : Mr. Adulellah Alaboudi (principal investigator) أ /عبدالاله العبودى
(Post graduate student, Faculty of Computing, Engineering and Since –Staffordshire University, UK)

Supervisor : Prof. Tony Atkins.
Co-Supervisor : Dr. Justin Champion

From : Regional Research Ethics Committee
Registered in National Committee of Bio. & Med. Ethics
Registration # (H-04-Q-001)

Research Title: "A Holistic Frame work for Assessing Tele-medicine Applications in Saudi Arabia (Saudi Tele-medicine Network STmN)"

Dear P.I

Thank you for submitting your research project to MERC for approval. We appreciate your efforts to meet the criteria requested by Qassim Regional Ethics Committee.

- **Decision: APPROVAL**
- **Revision type: Expedited**
- **Study design: A Survey**

Your research proposal is APPROVED by the Qassim Regional Research Ethics Committee

- You can start your research proceedings at your convenience.
- Also, you shall be responsible for preserving participants' information, and confidentiality.
- A written approval from King Fahad Specialist Hospital–Buraidah, king Saud Hospital-Unaizah, Buraidah Central Hospital and Al-Rass Hospital Directors has to be granted to the study PI before any field work to be done.
- On receiving this approval, you may conduct your research. However, if publication is intended please submit to the committee a new request identifying the name of periodical/ journal.
- Kindly, be aware that this approval embraces no financial (or other) obligations or responsibilities from the side of the Saudi Ministry of Health and all it is health facilities

For any questions or enquiries, please call Dr. Amel A. Suliman at telephone # (016)3231874 ext.111 (Email: qassim_ethicom@yahoo.com).

Best regards,,,,

Chairman, Regional Research Ethics Committee - Qassim Province
Dr. Abdullah M. Al Saigul

Coordinator, Regional Research Ethics Committee - Qassim Province
Dr. Amel A. Suliman

www.qh.gov.sa بريدة – ص.ب : ٢٢٩٥ هاتف : ٣٢٣١٧١٨ – ٣٢٣٥٥٠٦ تلكس : ٣٠١٢٩٩ فاكس : ٣٢٣١١٥٨

١/٢

KINGDOM OF SAUDI ARABIA
MINISTRY OF HEALTH
GENERAL DIRECTORATE OF HEALTH AFFAIRS
AL-QASSIM REGION

المملكة العربية السعودية
وزارة الصحة
(٢٧٥)
المديرية العامة للشئون الصحية بمنطقة القصيم
(٤٠٠)

وزارة الصحة
Ministry of Health

الرقم : ..... التاريخ ..... المشفوعات :.....

الموضوع :.....

KING FAHAD SPECIALIST HOSPITAL ,BURAIDAH AL QASSIM K.S.A.

Date : June ,2016
Ramadan,1437

TO WHOM IT MAY CONCERN

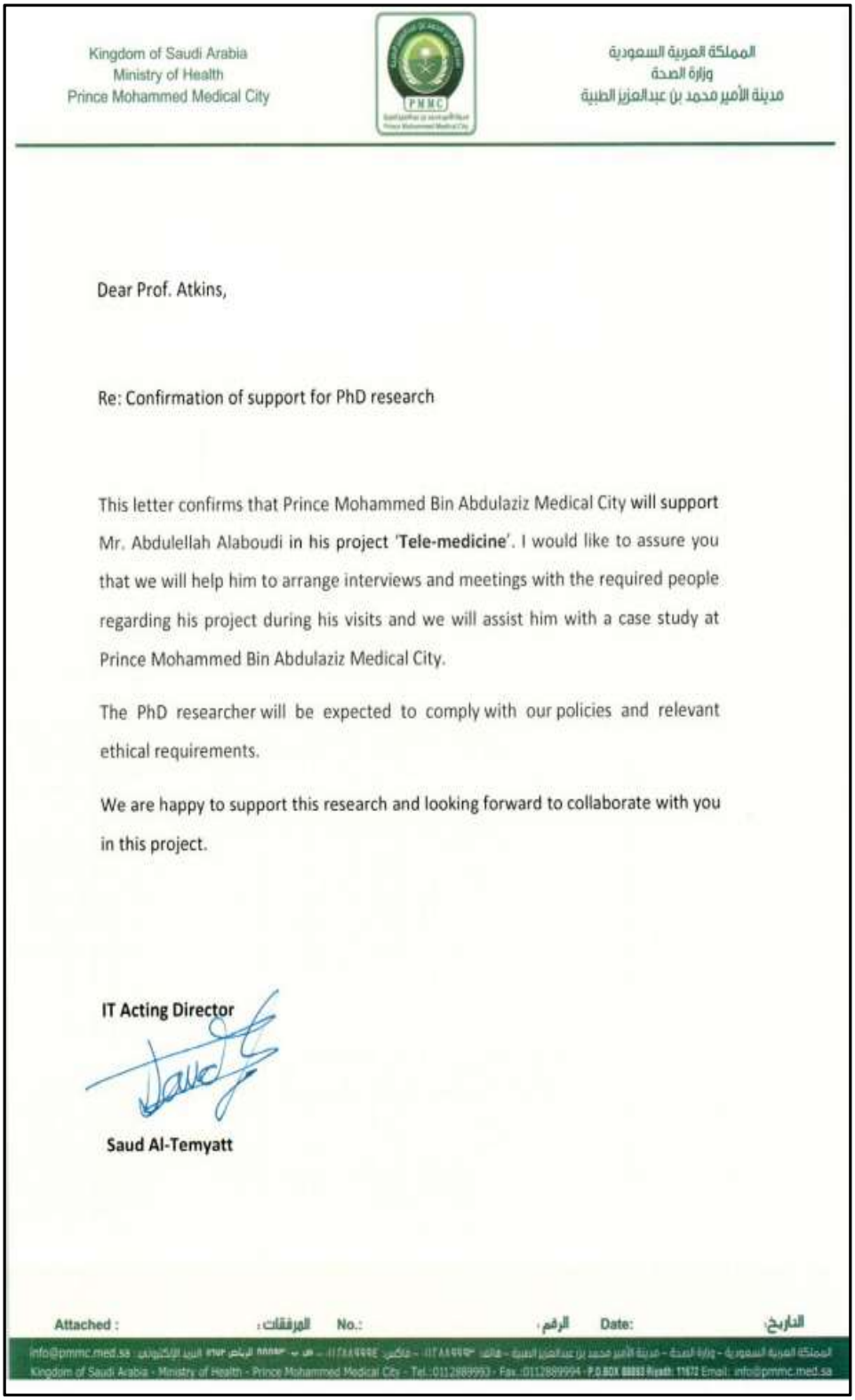
This is my pleasure to applause, Mr. Abdulellah Alaboudi he worked as a training and Research in- A Holistic Frame work for Assessing Tele – medicine Application in Saudi Arabia(Saudi Tele-medicine Network STmN) for three (3) months , starting Jumada Thane 23,1437 (April 1, 2016) till end of June 2016 (Ramadan, 1437) .

He has good knowledge and doing his job excellently.

He has a pleasant and cooperative outlook and keen to help others.
I wish him successful life and also recommend for a position as professional in any institution.

L.Sp. HAMOUD AL BAUTI
Supervisor Electronic Health Center
KFSH, Buraidah Al Qassim

www.qh.gov.sa بريدة - ص.ب : ٢٢٩٥ هاتف : ٠١٦٣٢٣١٧١٨ - ٠١٦٣٢٢٥٥٠٦ - تلكس : ٣٠١٢٩٩ فاكس : ٠١٦٣٢٣١١٥٨



Kingdom of Saudi Arabia
Ministry of Health
Prince Mohammed Medical City

المملكة العربية السعودية
وزارة الصحة
مدينة الأمير محمد بن عبدالعزيز الطبية

Dear Prof. Atkins,

Re: Confirmation of support for PhD research

This letter confirms that Prince Mohammed Bin Abdulaziz Medical City will support Mr. Abdulellah Alaboudi in his project '**Tele-medicine**'. I would like to assure you that we will help him to arrange interviews and meetings with the required people regarding his project during his visits and we will assist him with a case study at Prince Mohammed Bin Abdulaziz Medical City.

The PhD researcher will be expected to comply with our policies and relevant ethical requirements.

We are happy to support this research and looking forward to collaborate with you in this project.

IT Acting Director

Saud Al-Temyatt

Attached : المرفقات : No.: الرقم : Date: التاريخ :

Kingdom of Saudi Arabia - Ministry of Health - Prince Mohammed Medical City - Tel.:0112889993 - Fax.:0112889994 - P.O.BOX 88888 Riyadh: 11672 Email: info@pmmc.med.sa

Appendix C: The questionnaire

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Dear Sir/Madam:

Telemedicine has been approved and seems to be a promising solution in healthcare delivery. Despite emerging evidence about the benefits of telemedicine, there are some barriers to its adoption.
This questionnaire supports a study aiming to identify the factors that influence the adoption of telemedicine in Healthcare Facilities (HCF) in Kingdom of Saudi Arabia (KSA) context by investigating the opinions of the decision makers of HCFs in KSA.
This questionnaire in collaboration with the National eHealth Strategy and Change Management Office in the Ministry of Health (MOH) in KSA. This questionnaire is part of a PhD research being undertaken at Staffordshire University. The research is sponsored by the Ministry of Education (MOE) in KSA.

Note that:

1. **DO NOT** participate in this questionnaire if you are vulnerable to coercion or undue influence (e.g., unable to consent, less than 18 years, Prisoner, etc.).
2. For the purpose of this questionnaire, the term telemedicine refers to telemedicine services, which are not used directly by citizens (e.g. service users) but primarily by clinical staff (e.g., doctors/physicians, nurses, and other care providers- (clinical staff to clinical staff "business-to-business/Employees-to-Employees eServices") - who need additional input from specialists to improve the service that they deliver.
3. All answers will be treated in confidence and names of participants are not required.
4. You can stop at any time during the questionnaire.
5. While your cooperation in answering every question will help us understand important questions with regards to telemedicine implementation in HCFs in KSA, you are not obligated to answer every question.
6. Your participation in this project is voluntary.
7. If you agree to participate, you can withdraw from participation at any time before submission without any consequences.
8. Your decision to participate or not to participate will not affect your relationship with the MOH or MOE in any way.
9. There are no direct benefits to you for participating in this research.
10. There are no risks associated with participation.
11. By returning the completed questionnaire, you accept to participate in this study.
12. This questionnaire is available in two languages (Arabic and English).
13. This questionnaire is available in two different types of media (paper-based/printed papers and web-based http://staffordshire.cu.qualtrics.com/SE/?SID=SV_24fs5GUB55Zhgrj). If you decide to complete the paper-based/printed papers questionnaire, once you complete it, please send it back to the department of public relationship in your HCF. If you decide to complete the web-based questionnaire, your response will be sent directly to the researchers.
14. If you have any questions about the questions or this study, please contact the researchers via the contact information provided below: **(Questionnaire's code number: 201504-0003).**

Abdulellah Alaboudi
PhD Researcher
Shaqra University, KSA
Staffordshire University
alaboudi@su.edu.sa

Ahmed Balkhair, Paediatrician, Health Information
The Director of the eHealth Strategy and Change Management Office
Ministry of Health in Saudi Arabia
abalkhair@moh.gov.sa

Tamara Sunbul, MD, CPHIMS
Clinical Informatics
Johns Hopkins Aramco Healthcare
Tamara.sunbul@jhah.com

Mohammed Salem Alzahrani
Assistant Professor of Industrial Engineering
College of Engineering at Al Leith
Umm Al-Qura University
msjzahrani@uqu.edu.sa

Saud Al-temyatt
The Director of the Operations Planning Department and ICT Consultant
Prince Mohammad Medical City (PMMC)
saud.altemyatt@pmmc.med.sa

It will take about **15-20 minutes** to complete the questionnaire.

~~SUBMITTED~~ APPROVED 18 MAR 2015

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Abbreviations

DRP	Disaster Recovery Plan
HCF	Healthcare Facility
HR	Human Resource
ICT	Information and communications Technology
KSA	Kingdom of Saudi Arabia
MOH	Ministry Of Health
STN	Saudi Telemedicine Network

Glossary

Clinical staff	The human workforce who deliver healthcare services and they are essential to the performance of healthcare systems. Clinical staff includes health professionals, health associate professionals, allied health professionals, and personal healthcare workers in healthcare services (e.g., doctor/ physicians, nurses, pharmacists, dentists, medical laboratory, and radiology technician/ specialist).
Competitive advantages	Or Perceived Benefits, in this questionnaire, are the positive impacts or benefits that the telemedicine may bring to the HCF(e.g., maximise resources use, enhance productivity, enhance efficiency, increase profits, save time, quick decision making, quick response, effective information/knowledge sharing, enhance collaboration, minimise mistakes, environmental friendly, etc.)
Saudi Telemedicine Network (STN)	One of the MOH in KSA projects, and aiming to cover all HCFs in order to enable them to provide healthcare services to all residents in KSA via telemedicine applications
The STN agency	A full funded national-level (governmental) agency for the STN supported by the MOH in KSA as an enabler and a provider of telemedicine services in KSA and focused on the development and promotion of telemedicine and its applications.
Telemedicine	A sub-field of eHealth and defined as the uses of ICT to diagnose, treat disease and ill-health and overcome geographical barriers by the interactive transmission of clinical data, signals and biomedical images of patients. In other words, telemedicine is the use of ICT to provide healthcare services when distance separates the participants.
Tele-Conference (consultation)	A part of Telemedicine and it is the use of ICT to enable the virtual communication link between clinical staff of different disciplines in other HCFs including simple consultations in the ICU, OR , and ER departments.
Tele-Dermatology	A part of telemedicine application and it is the use of ICT to transmit medical information concerning skin conditions (e.g. tumours of the skin) for the purpose of interpretation and/or consultation.
Tele-ER	A part of telemedicine application lets the ER/trauma/emergency consultant or specialist from different location can remotely and fully access to all the monitors in ER/A&E resuscitation room via this telemedicine application to give instructions for the clinical staff to perform the resuscitation steps.
Tele-Pathology	A part of telemedicine application and it is the use of ICT to transmit digitised pathological results (e.g. microscopic images of cells) by using an accepted medico-Legal method for the purpose of interpretation and/or consultation.
Tele-Psychiatry	A part of telemedicine application and it is the use of ICT for psychiatric evaluations and/or consultation via video and telephony.
Tele-Radiology	A part of telemedicine application and it is the use of ICT to transmit digital radiological images (e.g. X-ray images) from one location to another for the purpose of interpretation and/or consultation.
Tele-stroke	A part of telemedicine application and it is the use of ICT by clinical staff who have advanced training in the nervous system (neurologists) to evaluate remotely people who have had acute strokes and make diagnoses and treatment recommendations to other clinical staff at other sites.
Tele-surgery / Tele-O.R.	A part of telemedicine application lets a surgeon in different location remotely uses and fully controls robotics via this telemedicine application to perform an operation.

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1- Job title:

- ☐ C-Level Executives in the MOH or any HCFs in KSA.
  Including Chief Executive Officers, Chief Operating Officers, Chief Medical Officers, Chief Clinical Officers, Chief Financial Officers, Chief Information Officers, Chief Technology Officers, etc.
- ☐ Director, vice president, or manager in the MOH or any HCFs in KSA
- ☐ Director or Head of Information Technology, Informatics, Technology in the MOH or any HCFs in KSA
- ☐ Healthcare Policy Makers and Regulators in the MOH or any HCFs in KSA.
- ☐ Senior Managers in the MOH or any HCFs in KSA
- ☐ Administrator in the MOH or any HCFs in KSA
- ☐ Other. **Please end the questionnaire if you are not one of the above**

2- Gender:

- ☐ Male
- ☐ Female

3- Age:

Please specify..... Years

4- Work experience:

Please specify, ... Years

5- Have you ever heard of telemedicine before?

- ☐ Yes.
- ☐ No. go to Q#8

6- Has your HCF ever participated in any telemedicine project? Or does your HCF currently offer telemedicine services?

- ☐ Yes
- ☐ No go to Q#8

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7- Which telemedicine services are currently offered within your HCF:

Please do not mix and be confused between tele-consultation and other telemedicine services. For instance, any telemedicine services without fully and remotely control and monitor between any clinical staff (e.g., physicians, nurses, etc.) in ICU, ER/A&E, or O.R. department is named "**tele-consultation**".

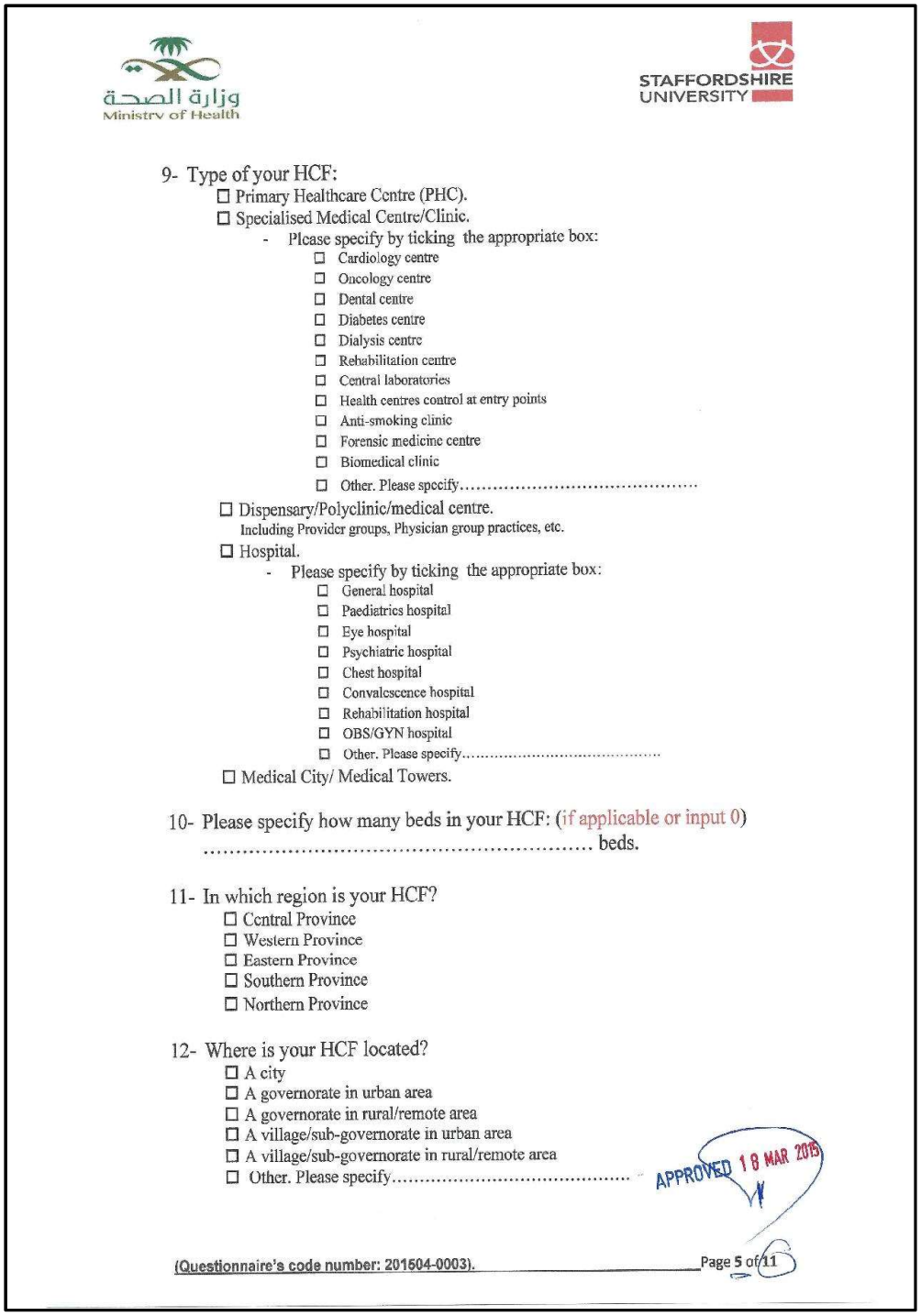
- ☐ Tele-Radiology
- ☐ Tele-Clinic
- ☐ Tele-ICU
- ☐ Tele-Conference (consultation)
- ☐ Tele-ER/ Tele-Trauma/ tele-Emergency
- ☐ Tele-Triage
- ☐ Tele-Homecare Cardiology/Electrocardiography (Tele-ECG).
- ☐ Tele-Surgery/ Tele-O.R.
- ☐ Tele-Patient monitoring
- ☐ Tele-Stroke
- ☐ Tele-Laboratory services
- ☐ Tele-Rehabilitation
- ☐ Tele-Pathology
- ☐ Tele-Dermatology
- ☐ Tele-Psychiatry
- ☐ Other, Please specify: ....

8- Which sector of the HCF are you working in:

- ☐ Ministry of Health sector.
- ☐ Military sectors.
  Including the HCFs under Ministry of Defence, Saudi Armed Forces, Ministry of National Guard, and Ministry of Interior.
- ☐ Other governmental sectors.
  Including the HCFs under universities, Royal Commission in Jubail and Yanbu, Ministry of Education (school healthcare units), the General Authority for Youth Welfare, Saudi Red Crescent Society, Water Desalination Corporation, Institute of Public Administration, King Faisal Specialist Hospital & Research Centre, etc.
- ☐ Private sector.

APPROVED 18 MAR 2015

(Questionnaire's code number: 201504-0003). Page 4 of 11



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9- Type of your HCF:

- ☐ Primary Healthcare Centre (PHC).
- ☐ Specialised Medical Centre/Clinic.
  - Please specify by ticking the appropriate box:
    - ☐ Cardiology centre
    - ☐ Oncology centre
    - ☐ Dental centre
    - ☐ Diabetes centre
    - ☐ Dialysis centre
    - ☐ Rehabilitation centre
    - ☐ Central laboratories
    - ☐ Health centres control at entry points
    - ☐ Anti-smoking clinic
    - ☐ Forensic medicine centre
    - ☐ Biomedical clinic
    - ☐ Other. Please specify.....
- ☐ Dispensary/Polyclinic/medical centre.
  Including Provider groups, Physician group practices, etc.
- ☐ Hospital.
  - Please specify by ticking the appropriate box:
    - ☐ General hospital
    - ☐ Paediatrics hospital
    - ☐ Eye hospital
    - ☐ Psychiatric hospital
    - ☐ Chest hospital
    - ☐ Convalescence hospital
    - ☐ Rehabilitation hospital
    - ☐ OBS/GYN hospital
    - ☐ Other. Please specify.....
- ☐ Medical City/ Medical Towers.

10- Please specify how many beds in your HCF: (if applicable or input 0)
..... beds.

11- In which region is your HCF?

- ☐ Central Province
- ☐ Western Province
- ☐ Eastern Province
- ☐ Southern Province
- ☐ Northern Province

12- Where is your HCF located?

- ☐ A city
- ☐ A governorate in urban area
- ☐ A governorate in rural/remote area
- ☐ A village/sub-governorate in urban area
- ☐ A village/sub-governorate in rural/remote area
- ☐ Other. Please specify.....

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(Questionnaire's code number: 201504-0003). Page 5 of 11

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13- How important do you feel is the utilisation of telemedicine services to your HCF organisation?

- ☐ Very important
- ☐ Important
- ☐ Somewhat important
- ☐ Somewhat important, but we are considering a greater emphasis
- ☐ Not important, and we do not have plans to focus on telemedicine

14- Which of followings is currently available in your HCF:

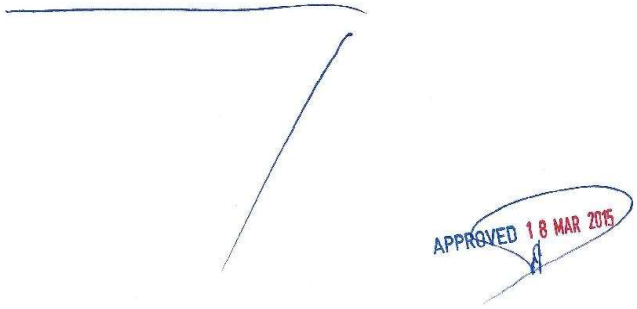
- ☐ An internet access
- ☐ A Local Area Network (LAN) and basic ICT infrastructure
- ☐ Computer applications that are used by clinical staff to do their job and provide healthcare services
- ☐ Its own Information and Communication Technology (ICT) staff

15- Do you think clinical staff's acceptance and use of telemedicine will be easy and more acceptable if its use is mandatory?

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Somewhat Disagree
- ☐ Uncertain
- ☐ Somewhat Agree
- ☐ Agree
- ☐ Strongly Agree

16- How do you think the clinical staff could be reimbursed for using telemedicine:

- ☐ The reimbursed for telemedicine services should be **higher than rate** for traditional interaction (in-person healthcare)
- ☐ The reimbursed for telemedicine services should be **the same rate** for traditional interaction (in-person healthcare)
- ☐ The reimbursed for telemedicine services should be **lower than rate** for traditional interaction (in-person healthcare)
- ☐ Other. Please specify.....



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1. Human Context:

For each statement, please indicate to the extent on a scale, from Strongly not influence to Strongly influence, your opinions regarding the important factors that influence your decision to implement the proposed telemedicine application in your HCF by ticking the appropriate box:

Q#	barrier	The statement	Strongly not influence	Not influence	Somewhat not influence	Uncertain	Somewhat influence	Influence	Strongly influence
17	User acceptance	The acceptance of the users (i.e., clinical staff) of my HCF and their willingness to use the proposed telemedicine application (e.g., provide a consultation)							
18	Consumer acceptance	Public accceptance (i.e., the acceptance of the consumers (e.g., citizens) of my HCF							
19	The availability of internal/external experts	Conformity of proposed telemedicine application with the capability, skilled, and knowledge (expertise) of the human resources (HR) of my HCF							
20		The availability of adequate HR in my HCF to implement, operate, and maintain the proposed telemedicine application.							
21		The availability of external experts skilled staff or consultants to be hired in my HCF if required to implement and deal with the proposed telemedicine application							

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2. Organisational Context:

For each statement, please indicate to the extent on a scale, from Strongly not influence to Strongly influence, your opinions regarding the important factors that influence your decision to implement the proposed telemedicine application in your HCF by ticking the appropriate box:

Q#		The statement	Strongly not influence	Not influence	Somewhat not influence	Uncertain	Somewhat influence	Influence	Strongly influence
22	Strategy and Plans	The presence of approved strategy and plans (e.g., change management plan, risk management plan, etc.) in my HCF for implementing telemedicine solutions							
23	Organisational Constraints	Conformity of the proposed telemedicine application with core mission, vision, and needs of my HCF							
24		Conformity of proposed telemedicine application with the bylaw (i.e., the local laws) of my HCF							
25	Services Impacts	The ability to bring competitive advantages to my HCF during the use of the proposed telemedicine application							
26		The ability to solve challenges that currently face my HCF							
27	Structure Impacts	Ensuring the placement of telemedicine in my HCF structure (e.g., my HCF has a formal telemedicine department).							
28	Managerial support and Commitment to Change	The support and encouragement of the stakeholders of my HCF and their intention toward the adoption of the proposed telemedicine application							
29		Willingness and commitment of the stakeholders of my HCF to make the required modifications in its bylaw such as human resources policies and roles (e.g., compensation, appraisal, and training) to fit with the proposed telemedicine application or in order to make the use of it more efficient.							
30		Willingness and commitment of the stakeholders of my HCF to make the required modifications in its business processes/workflow/care pathways and reengineer/redesign them to fit with the proposed telemedicine application or in order to make the use of it more efficient.							

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3. Technical Context:

For each statement, please indicate to the extent on a scale, from Strongly not influence to Strongly influence, your opinions regarding the important factors that influence your decision to implement the proposed telemedicine application in your HCF by ticking the appropriate box:

Q#		The statement	Strongly not influence	Not influence	Somewhat not influence	Uncertain	Somewhat influence	Influence	Strongly influence
31	Availability	Ensuring conformity of the proposed telemedicine application with the capability of current ICT of my HCF							
32		Ensuring conformity of the proposed telemedicine application with the ICT policies, standards (e.g., ICT Security Procedures) of my HCF							
33		The availability of the required data and information of patients from their health records (such as blood test result, x-ray film, and other test results) which have been completed by my HCF to be shared in order for the proposed telemedicine application to complete its services							
34	Essential System Characteristics	Ensuring the provider (the STN agency) of the proposed telemedicine application has a Disaster Recovery Plan (DRP) to recover and protect the proposed telemedicine application in the event of a disaster for ensuring services continuity, availability, and stability							
35		Ensuring the provider (the STN agency) of the proposed telemedicine application has suitable customer service support							
36		Ensuring interoperability between the proposed telemedicine application and existing technology/systems/applications in my HCF							
37		Ensuring confidentiality and privacy of information in proposed telemedicine application and there are no security issues regarding the use and access to the proposed telemedicine application							
38		The implementation difficulty (complexity) of the proposed telemedicine application.							
39		Ensuring the quality, conviviality, performance (validity and reliability) of services, and that proposed telemedicine application provides							

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4. Environmental Context:

For each statement, please indicate to the extent on a scale, from Strongly not influence to Strongly influence, your opinions regarding the important factors that influence your decision to implement the proposed telemedicine application in your HCF by ticking the appropriate box:

Q#		The statement	Strongly not influence	Not influence	Somewhat not influence	Uncertain	Somewhat influence	Influence	Strongly influence
40	Industry Characteristics and Market Structure	External pressures (e.g., from KSA's government, provider, partners, vendors, etc.)							
41		The possibility of interoperability and interconnectivity of proposed telemedicine application with other HCF telemedicine systems inside and outside KSA							
42		The ability to provide a competitive advantage over other partners (HCFs) with the use of the proposed telemedicine in my HCF							
43		Sufficient external support (e.g., from KSA's government, provider, partners, vendors, etc.)							
44	Support and quality of basic facilities and ICT Infrastructure	The availability of efficient vendors and suppliers of ICT services (ICT companies) from the local market to provide the required ICT equipment at affordable prices.							
45		Conformity of the proposed telemedicine application with the available technologies external to my HCF (exist but are not yet in use at my HCF)							
46		The availability and quality of the required ICT infrastructure and facilities (e.g., power supply, high internet access) in the surrounding environment (where the HCF is located)							
47	Government Legislations	The availability of clearly defined legislations (e.g., laws, policies, regulations) in the KSA that coordinate the access to and use of telemedicine.							
48		Conformity of my HCF with the STN legislations (e.g., laws, regulations, communication standards)							
49		Expected managerial obstacles such as the excessively complicated administrative procedures (bureaucracy) inside governmental agencies.							
50		Conformity of proposed telemedicine application with the surrounding culture and society							
51		Politics and political situations							
52		Economy and economic recession							
53		The ability of the proposed telemedicine application to support the 'green environment' (e.g., reducing waste paper, X-ray films) in my HCF							

APPROVED 18 MAR 2015

(Questionnaire's code number: 201504-0003). Page 10 of 11

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5. Business –Financial Context:

For each statement, please indicate to the extent on a scale, from Strongly not influence to Strongly influence, your opinions regarding the important factors that influence your decision to implement the proposed telemedicine application in your HCF by ticking the appropriate box:

Q#	The statement	Strongly not influence	Not influence	Somewhat not influence	Uncertain	Somewhat influence	Influence	Strongly influence
54	Ensuring the economic feasibility (e.g., cost-effectiveness) and the commercial viability of the proposed telemedicine application.							
55	Ensuring the cost-effectiveness of the proposed telemedicine application for the citizens (e.g., the possibility of reducing the burden of travel for citizens to be treated which is important in the tradition interactions (in-person visits) to meet in the same geographical location)							
56	The availability of adequate financial resources in my HCF to implement, operate, and maintain the proposed telemedicine application.							
57	The availability of adequate sustainable funding/financial support from outside my HCF such as from the KSA government or other organisations.							
58	The reimbursement for the proposed telemedicine application services is an important factor that influences my decision to implement it in my HCF							

Please specify any other important factors you think they may influence your decision to implement the proposed telemedicine application in your HCF.

.....
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Please enter your email address if you wish to be informed about the findings of this study:

.....

End of questionnaire....Thank you for your participation.

APPROVED 18 MAR 2015

(Questionnaire's code number: 201504-0003). Page 11 of 11

Appendix D: The results of the pilot tests of the questionnare

Pillars	N of Items (related barriers)	Barrier's abbreviation	Factor loading	AVE	Cronbach's α
Human	2	Hu1	0.661	0.643	0.872
		Hu2	0.916		
organisational	4	Or1	0.713	0.749	0.839
		Or2	0.882		
		Or3	0.918		
		Or4	0.783		
Technological	4	Te1	0.873	0.772	0.823
		Te2	0.774		
		Te3	0.806		
		Te4	0.842		
Environmental	5	En1	0.774	0.657	0.853
		En2	0.917		
		En3	0.827		
		En4	0.833		
		En5	0.876		
Business-financial	2	BF1	0.828	0.655	0.868
		BF2	0.795		
All questionnaire	17			0.881	0.897