Faculty of Information and Communication Technology

CRITICAL FACTORS IN ELECTRONIC HEALTH READINESS ASSESSMENT FRAMEWORK FOR IRAQ HEALTH SERVICES

Saif Mohammed Ali

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CRITICAL FACTORS IN ELECTRONIC HEALTH READINESS ASSESSMENT FRAMEWORK FOR IRAQ HEALTH SERVICES

SAIF MOHAMMED ALI

A thesis submitted
in fulfilment of the requirements for the degree of Doctor of Philosophy

Faculty of Information and Communication Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2019

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DECLARATION

I declare that this thesis entitled "Critical Factors in Electronic Health Readiness Assessment Framework for Iraq Health Services" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : …….

Name : Saif Mohammed Ali

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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Doctor of Philosophy.

Signature : …….

Supervisor Name : Assoc. Prof. Dr. Burhanuddin Bin Mohd Aboobaider

Date : ……..…….

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DEDICATION

The name of Allah, my Creator and my Master.

My great teacher and messenger, Mohammed (May Allah bless and grant him), who taught us the purpose of life.

Universiti Teknikal Malaysia Melaka; my second magnificent home.

My great parents, who never stop giving of themselves in countless ways.

My dear wife, who leads me through the valley of darkness with light of hope and support.

My beloved brother and sisters; particularly my dearest brother, AWS, who stands by me when things look bleak.

My beloved kids: Ali and Mayar, whom I can't force myself to stop loving.

To all my family, the symbol of love and giving.

My friends who encourage and support me.

I dedicate this research.

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ABSTRACT

Electronic Health (e-Health) is an application of Information and Communication Technologies (ICT) across the range of functions that affect health. e-Health has become a sturdy and versatile platform that can facilitate the enhancement of information and services delivery in the health industry. e-Health readiness assessment is a basis for ICT investments in healthcare organizations. Assessing health readiness is impacted by several factors. Even though there is an abundance of evidence of the subject of healthcare in the literature, studies that have investigated the factors affecting its assessment in the developing countries is still limited. In Iraq, e-Health readiness is still in its nascent stage. Therefore, this study aims to assess the contribution of the critical factors leading to e-Health readiness assessment in healthcare institutions in Iraq. The proposed e-Health readiness assessment framework consists of four dimensions. These are Individual Readiness, Environment Readiness, Core Readiness, and Technological Readiness. The fundamental theories applied to develop the framework were Theory of Transtheoretical Model, Activity Theory, Resource Based View, Theory of the Diffusion of Innovation, and Institutional Theory. The proposed framework was test with a self-administered survey, involving samples of 211 medical staff and 104 technical staff from various healthcare organizations in Iraq. The data collected from the survey were analysed using the Statistical Software, SPSS and Partial Least Squares, PLS for Structural Equation Modelling. The findings revealed that a number of factors, namely Attitudes, Training, Government Regulation, Economic, Genuine Need of change, Acceptability, Compatibility, Availability and Affordability of the hardware and software, ICT Support Service, Network Reliability, and Privacy and Security, were identified to have the most significant effect on the E-Health readiness assessment of these healthcare organizations. The proposed study is useful to the medical and technical staff with regard to their beliefs in the use of e-Health. In addition, the proposed model in this study was validated to be more effective for the assessment of e-Health readiness in Iraqi healthcare institutions with experts agreement rate of 87.3%. These significant findings have crucial implications and valuable contributions in the body of knowledge of e-Health, smart computing in particular and information system in general.

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ABSTRAK

Kesihatan Elektronik (e-Kesihatan) adalah aplikasi Teknologi Maklumat dan Komunikasi (ICT) dalam pelbagai fungsi yang memberi kesan kepada kesihatan. e-Kesihatan telah menjadi pelantar yang kukuh dan serba boleh yang dapat mempermudahkan peningkatan penyampaian maklumat dan perkhidmatan di dalam industri kesihatan. Penilaian kesediaan e-Kesihatan adalah asas untuk pelaburan ICT di dalam organisasi penjagaan kesihatan. Penilaian kesediaan penjagaan kesihatan dipengaruhi oleh beberapa faktor. Walaupun terdapat banyak bukti mengenai subjek penjagaan kesihatan di dalam kajian literatur, namun faktor-faktor yang mempengaruhi penilaiannya di negara-negara yang membangun masih terhad. Di Iraq, kesediaan e-Kesihatan masih berkembang di peringkat awal. Oleh itu, kajian ini bertujuan untuk menilai sumbangan faktor kritikal yang membawa kepada penilaian kesediaan e-Kesihatan di institusi-institusi kesihatan di Iraq. Kerangka kerja penilaian kesiapan e-Kesihatan yang dicadangkan ini terdiri daripada empat dimensi. Ini adalah Kesediaan Individu, Kesediaan Persekitaran, Kesediaan Teras, dan Kesediaan Teknologi. Teori-teori asas yang digunakan bagi membangunkan kerangka kerja di dalam kajian ini ialah penilaian Teori Model Transteoritikal, Teori Kegiatan, Pandangan Berdasarkan Sumber, Teori Difusi Inovasi, dan Teori Institusi. Kerangka kerja yang dicadangkan ini telah diuji menggunakan kaji selidik secara kendiri terhadap 211 sampel kakitangan perubatan dan 104 sampel kakitangan teknikal dari pelbagai organisasi penjagaan kesihatan di Iraq. Data yang dikumpulkan ini telah dianalisa dengan menggunakan perisian statistik, SPSS dan Partial Least Squares, PLS untuk Pemodelan Persamaan berstruktur. Penemuan ini mendedahkan beberapa faktor, iaitu Sikap, Latihan, Peraturan Kerajaan, Ekonomi, Keperluan Tulen Perubahan, Penerimaan, Kesesuaian, Ketersediaan dan Keupayaan perkakasan dan perisian, Perkhidmatan Sokongan ICT, Kebolehpercayaan Rangkaian, dan Privasi serta Keselamatan yang dikenalpasti mempunyai kesan yang paling penting terhadap penilaian kesediaan e-Kesihatan bagi organisasi-organisasi penjagaan kesihatan. Kajian yang dicadangkan ini juga penting di kalangan kakitangan perubatan dan teknikal berkaitan dengan kepercayaan mereka di dalam penggunaan e-Kesihatan. Tambahan lagi, model yang dicadangkan di dalam kajian ini telah disahkan sebagai lebih berkesan untuk penilaian kesediaan e-Kesihatan di institusi penjagaan kesihatan Iraq dengan nisbah persetujuan pakar sebanyak 87.3%. Penemuan bermakna ini memberi implikasi penting dan merupakan sumbangan berharga bagi domain pengetahuan, khususnya dalam bidang e-Kesihatan, pengkomputeran pintar dan sistem maklumat umumnya.

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LIST OF ABBREVIATIONS

AT	-	Activity Theory
AVE	-	Average Variance Extracted
CID	-	Center of International Development's
CSPP	-	Computer Systems Policy Project
CB	-	Covariance-Based
DOI	-	Diffusion of Innovation
EDI	-	Electronic Data Interchange
EHR	-	Electronic Health Record
EMR	-	Electronic Medical Record
GIPI	-	Global Internet Policy Initiative
GIF	-	Government Interoperability Framework
HIT	-	Health Information Technology
HTMT	-	Heterotrait-Monotrait
ICT	-	Information and Communication Technology
ITC	-	Information Technology Centre

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MIS	-	Management Information System
PLS	-	Partial Least squares
RBV	-	Resource-based View
SPSS	-	Statistical Package for the Social Sciences
SEM	-	Structural Equation Modelling
TTM	-	Theory of Transtheoretical Model
UN	-	United Nations
UNAMI	-	United Nations Assistance Mission in Iraq
VIF	-	Variance Inflation Factor
WHO	-	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Generally, e-Health systems are utilized in the healthcare sectors for the purpose of supporting research activities, teaching, and public services. The efficiency of computing application in health sectors enables healthcare professionals to control and manage patients' health records (Hatch and Cunliffe, 2013). Electronic health systems can be effectively collected, stored, processed and exchanged using Information and Communication Technologies (ICTs). It has been shown that healthcare services can be improved in quality, safety and with reduced cost using ICT (Gagnon et. al., 2010). The implementation of technology in solving healthcare-related problems opens up commercial opportunities and resided efficiency level of healthcare delivery across both developed and developing nations.

Huge advances have been made in information technology especially in the health sector in the last two decades, with several designs of electronic health devices and their implementation (Avgerou and Walsham, 2017). Since the need for healthcare services are continuously increasing, it is important for the provision of healthcare services to be efficient and readily accessible (Cohen et. al., 2016). Healthcare based on the ICT (as e-Health) is promising and may help to overcome problems associated with the conventional (paper-based) healthcare. By definition, e-Health is the application of ICT in the process of delivering healthcare, such as in the treatment of patients, research purposes, disease monitoring, training, and public health monitoring (Lucas, 2008). More

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research attention is now given to e-Health (or e-Healthcare) owing to its broad patient involvement.

Organizations, professionals and especially patients and the public are expected to benefit from the implementation of e-Health. The review of the literature confirms the many significant benefits of e-Health to patients (Chaudhry et. al., 2006; Shekelle et. al., 2006; Earnest et. al., 2004). A major benefit that has been reported is the improvement in quality of care as a result of the ease of accessibility to patients' essential health data by their diferent health providers (Wilson and Lankton, 2004; Staroselsky et. al., 2006). Efficient, appropriate and the latest information can be provided to healthcare professionals for knowledge exchange and decision making using e-Health systems (Erstad, 2003). Also, clinical pratices, distribution of health sevices, quality of care, duplication of medical examinations, e\wrongful dispensation of medicines and patient safety can all be improved with e-health systems (King et. al., 2014). Moreover, patient safety can be protected by implementing the right e-Health system in the right way. The assessment of e-Health readiness will allow organizations facilitate successful implementation. E-Health readiness is defined as "the readiness of healthcare institutions and communities to receive the expected changes occurring from the introduction of ICT programmes" (Khoja et. al., 2007b).

Assessment of e-Health readiness should serve as part of pre-implementation evaluation to ensure that e-Health systems are successfully implemented (Jennett et. al., 2003, Demiris et. al., 2004). For example, possible reasons for not innovating can be identified from e-Health readiness assessment. Evidence to support the readiness (or lack of it) of an organization to be transformed before implementing e-Health, can be determined from e-Health readiness assessment (Ajami et. al., 2011). An organization lacking in readiness can be identified from the factors of failure within that organization.

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It is very important for organizations to be ready to implement all aspects of e-Health systems. The World Health Organization (WHO) and the United Nations (UN) are expected to recognise the importance of e-Health readiness in developing countries (Heeks, 2008). In Iraq for example, there is little progress in efforts to adopt ICT systems in the healthcare sector compared to that of other sectors such as finance, manufacturing, retail, and transportation industries (deGannes Scott, 2006, Lian et. al., 2014).

1.2 Background

The background of the study provides information concerning the challenges in implementation of the e-Health system. E-Health for healthcare has evolved due to the revolutionary advances made in ICT network technologies and the improvements in information management. The new technologies have transformed healthcare delivery (Bauer et. al., 2014) and modern technology has the capability to support and manage the various aspects of healthcare, ranging from searching general health information to consultations with physician without the need for patients to leave their homes. However, some limitations still exist, one of which is the lack of accessibility of patients to their most basic personal health information, such as test results, which are present in medical charts but unavailable to patients via e-Health technologies (Leonard and Wiljer, 2007). Thus, patients become inactive participants in e-Healthcare delivery due to the lack of access to their own information.

Readiness, which is carried out in the early stage of implementation of change (Lewin, 1951) is the cognitive precursor for measuring the support-for or resistance-to change (Armenakis et. al., 1993). This study was focused on readiness involving health workers' readiness and organizational readiness. Assessment of health workers' readiness relates to the e-Health record practices in hospitals (such as knowledge in, access to or

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difficulties in using computers) while organizational readiness involves the evaluation of organizational resources, (ICT infrastructure and finance required to implement e-Health).

Readiness assessment is required before implementing e-Health systems in healthcare organizations. Risk of failures in organizational projects can be reduced using readiness assessment (Demiris et. al., 2004). It is important to check the availability and local context of basic factors that will promote acceptance and utilization of e-Health. User information, organizational strengths and weaknesses can all be identified from readiness assessment (Weiner et. al., 2008). E-Health systems are capital intensive and their failure can be devastating for the implementing organization, which justifies the importance of readiness assessments (technical and social) prior to actual implementation.

Nonetheless, the recommendation of readiness assessment is often neglected in the implementation of ICT projects in public health sector for political as well as socio-cultural reasons (Touré et. al., 2012). Developing countries often lack some basic infrastructures and policies needed for implementing health-related projects. It therefore is highly important for healthcare institutions in developing countries preparing to adopt e-Health to conduct readiness assessment studies, in order to evaluate the organizational and local factors that are available or may be needed to facilitate the acceptance, utilization and sustainability of such initiative (Adjorlolo and Ellingsen, 2013).

These background studies have presented empirical confirmation from research carried out in the assessment of e-Health readiness. The findings from these previous researches done will offer information on contemporary trends in communication and systems implementation on national and global levels. The literature review section will present a history of e-Health systems and the process of assessment of e-Health readiness.

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1.3 Purpose of study

The purpose of this quantitative study is to assess the unique contribution of the critical factors leading to the development of an e-Health readiness assessment model for both public and private healthcare institutions in Iraq. This is necessary, as some of the healthcare providers have been slow to implement and upgrade the e-Health system even though the quality and efficiency of healthcare can be potentially enhanced. Since, organizations are moving from paper to electronic based patient charts, this research is ideal for the healthcare sector.

1.4 Significance of the study

This study provides sufficient understanding about the state of the current healthcare structure and system characteristics necessary for accommodating individual needs to be willing to assess and improve the readiness of e-Health in Iraqi healthcare organizations. Healthcare professionals have the responsibility to ensure consumers are knowledgeable in respect of the changes implemented for the use of e-Health, access to personal health information, and consumer rights for privacy and security.

The data collected from this study would be beneficial for government agencies and e-Health stakeholders. The government has taken advantage of technology by providing information on policy and services offered by governmental agencies, such as public health agencies, ministries of health, healthcare providers, international organizations, donor countries, aid agencies, which have taken on new roles to provide leadership in terms of strategic direction as it affects the entire nation and its healthcare sector (Abd Ghani et. al., 2008). Moreover, it also could be beneficial for researchers, health planners, academics, students, and other e-Health stakeholders who may need to know a country's e-Health readiness level. Having available an evidence-based and

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