e-Health Systems Adoption and Telemedicine Readiness: Practitioner Perspective from Libyan Healthcare Sector

A Thesis Submitted for the Degree of Doctor of Philosophy

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Abstract

Healthcare service providers have reasons to consider e-Health systems and Telemedicine solutions when determining the best practices for healthcare provision in developing countries. The focus of this research is to inspect the readiness to adopt e-Health systems at an organisational level in Libya and utilise Telemedicine technologies in order to provide healthcare to service users. The main application is monitoring chronic (ongoing) health conditions such as diabetes, high blood pressure, and also for patients following strokes and paralysis, regardless of where they are. This research highlights that the success of Telemedicine adoption could be influenced by various health-specific organisational factors including organisational capabilities and resources. This research aims to provide a model to assess the e-Health systems and Telemedicine readiness in Libya from the healthcare providers' perspective. This research employed a questionnaire-based survey targeting mainly Libyan clinicians and healthcare staff who are on training programmes and studying for further education in the UK and who have been healthcare providers in Libya. 161 participants responded to the questionnaire with a rate of 31% and the data was analysed using SPSS statistic software (V.20). This research has found that various organisational factors have an impact on Telemedicine adoption and thus on the implementation of such technology including Healthcare Provider (HP) HR, IT infrastructure, technology ease of use and healthcare providers' perspective. In the regression analysis, it was found that Telemedicine Readiness [influenced by Telemedicine Ease of Use, HP IT Infrastructure and HP HR Capability ($p < 0.001$, $R^2 = 0.472$)], Telemedicine Outcome Expectations [influenced by HP User Expectations and HP HR Capability ($p < 0.001$, $R^2 = 0.522$)] and HP Operational Capability [influenced by HP User Expectations, Telemedicine Ease of Use, HP Learning Capabilities and HP IT Infrastructure ($p < 0.001$, $R^2 = 0.353$)] have a positive significant impact on Telemedicine Adoption ($p < 0.001$, $R^2 = 0.477$). These findings indicate that in order to adopt Telemedicine technologies in healthcare establishments, the focus should be on human resources' capabilities and the first line staff such as clinicians and nurses with consideration to their involvement in project plans ensuring that the introduced Telemedicine technologies' compatibility with their routine practices would not be affected and the technology should be easy to use.

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Special thanks to my young family for their patience and support.

Dedication

This Work is Dedicated to:

Omi – Your Patience makes me Wonder,

Abbi – Your Voice brings me Peace.

So Far, Yet so Close

ارْحَمْهُمَا كَمَا رَبَّيَانِي صَغِيرًا

List of Publications

- Abdullrahim, A. and De Coster, R. (in press). Empirical Study of Telemedicine Readiness in the Healthcare Sector in Developing Countries. Special Issue Submission: Technology & Innovation: A Half-Century of Internet-Enabled Change. International Journal of Technology and Human Interaction (IJTHI).

- Abdullrahim, A. and De Coster, R. (2016). A framework of e-health systems adoption and telemedicine readiness in developing countries. IEEE International Conference on Information Society (i-Society 2016). Dublin, Ireland. pp. 105.

- Abdullrahim, A. and De Coster, R. (2015). An empirical study of telemedicine readiness to provide healthcare in Libya. Departmental Research Seminar April 2015. Brunel University, London, UK.

- Abdullrahim, A. and De Coster, R. (2014). A pilot study of telemedicine readiness and service value provision for patients with chronic conditions in developing countries. In International Colloquium on Design, Branding and Marketing (ICDBM 2014). Nottingham Trent University, Nottingham, UK.

- Abdullrahim, A. and De Coster, R. (2014). A study of utilizing telemedicine to provide healthcare in North Africa. 7th Annual Brunel University research conference (ResCon 2014). Brunel University, London, UK.

- Abdullrahim, A. and De Coster, R. (2012). A study into healthcare service innovation using ICT in developing countries. 5th Annual Brunel University research conference (ResCon 2012)

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ANOVA	Analysis of Variance
BP	Blood Pressure
ECG	Electrocardiography
EFA	Exploratory Factor Analysis
ETL	Extract, Transform, Load Data Management
GPRS	General Packet Radio Service
HR	Human Resources
HP	Healthcare Provider
ICT	Information Communications Technologies
IDT	Innovation Diffusion Theory
IS	Information Systems
IT	Information Technologies
KMO	Kaiser-Meyer-Olkin
LAN	Local Area Network
NCD	Non-Communicable Chronic Diseases
NHS	National Health Service in the UK
PCA	Principal Component Analysis
SD	Standard Deviation
SPSS	Statistical Package for the Social Science
TAM	Technology Acceptance Model
TM	Telemedicine
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Actions
WHO	World Health Organisation

Declaration

“Except for the help listed in the Acknowledgments, the contents of this PhD thesis are entirely my own work. This work has not been submitted, in part or in full, for a degree or diploma of this or any other University or Examining Board”

Signed by candidate:

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Date of submission:

Chapter One: Introduction

1.1. Research Background

Healthcare organisations certainly have good reasons to consider e-Health system and Telemedicine when determining the best ways to provide better healthcare service provisions under continuous pressures to reduce costs (Lindskog, Hemphälä, and Eriksson, 2015; Mackert, Whitten, and Krol, 2010; Whitten, Holtz, and Nguyen, 2010).

The term e-Health was first used by people in business and marketing. They generated this term in keeping with other "e-words" such as e-commerce (electronic commerce) and e-business, in an effort to transfer the promises, principles, excitement around e-commerce to the healthcare field, and to address the potentials the information communication technologies could have to the healthcare industry (Eysenbach, 2001). Telemedicine is the zone where information communication technology and medicine overlap and it is believed this could have a major impact on healthcare delivery (Craig and Patterson, 2005). Telemedicine was defined by Field (1996) as "*the use of electronic information and communications technologies to provide and support healthcare when distance separates the participants*".

El-Taguri et al. (2008) stressed that limited resources are a major issue in shaping and managing healthcare systems in both developing and industrialised countries alike and it is important to guarantee that the restricted resources are sensibly spent so as to accomplish the maximum returns for minimum expenditure. Paim et al. (2011) pointed out in their research that the healthcare systems in developing countries are confronted with challenges and barriers such as infrastructure and technology issues, cost-effectiveness, growing population including increasing numbers of senior citizens whose healthcare system should pay closer attention to them, and shortages of medical and non-medical staff in providing healthcare services to healthcare users.

As per the report presented in 2014 by the World Health Organisation (WHO), the leading cause of death globally, Non-Communicable Chronic Diseases (NCDs) such as diabetes, obesity and cardiovascular diseases, were responsible for 38 million (68%) of the world's 56 million deaths in 2012.

More than 40% of them (16 million) were premature deaths under the age of 70 years. Almost three quarters of all NCD deaths (28 million), and the majority of premature deaths (82%), occur in low- and middle-income countries (WHO, 2014). Currently, there are more than 150 million patients that are suffering from diabetes alone (Kovacs-Burns et al., 2013). The majority of premature NCD deaths are preventable and these member states should improve on these goals to achieve the overarching target of a 25% decrease of premature mortality from the NCDs by 2025 (WHO, 2014).

Abdul-Rahim et al. (2014) reported that in 2008, more than 1.2 million people in the Middle East and North African region died from NCDs, accounting for nearly 60% of all deaths in the region, with wide variations between countries ranging from 27% in Somalia to about 84% in Oman and Lebanon. More than 34% of deaths from NCDs were in individuals younger than 60 years.

Chorin, (2014) reported that Libya's status in this regard is very high in all main cardiovascular risk factors, including diabetes, hypertension (high blood pressure) and retinopathy (damage to the retina of eyes). The causes include genetic reasons, diet, as well as health neglect and preventative healthcare. The cases of diabetes in Libya are estimated to be 16.4% out of a population of just over 6 million (Chorin, 2014).

The World Health Organisation (2007) report showed that the increasing figure and the scattering of population in a large-sized country such as Libya sets a strain on the accessibility and the infrastructure availability to provide healthcare for all inhabitants. The health status in Libya has changed, according to WHO, from a high incidence of communicable illnesses and mortalities, to one where mortality and disease is more often associated with non-communicable chronic illnesses.

The report further showed that Libya spends 222 USD per person per annum (less by 3.3% in comparison with the Middle East and North African Region) taking into account that the population is more than six million according to a census produced in 2006. 30.5% of this spending was on staff costs, 30% on medications and 24% on investments. Furthermore, the Government spends 131 million USD per annum for medical treatment of its citizens abroad. More are spent out-of-pocket by Libyans themselves using private sector healthcare provision or travelling abroad for medical treatments to neighbouring countries and Europe in order to receive better level of healthcare services despite guaranteed free healthcare in the public sector (WHO, 2007).

1.2. Research Motivation

There is a lack of studies in the literature regarding the use of e-Health systems and Telemedicine in Libya to treat and manage NCDs or any other diseases and this suggests the need to assess the readiness to adopt and eventually implement and sustain Telemedicine technologies and e-Health systems. Additionally, Telemedicine solutions, such as electronic medical records, are not yet deployed in Libya's health institutions. These might develop management of clinicians, decrease inefficiency, improve effectiveness and overall healthcare provision, and increase safety (WHO, 2007). Such technologies will have implications on healthcare access, especially to people in rural areas and patients with chronic diseases, and further reshape the healthcare system in Libya.

1.3. e-Health and Telemedicine Potential

According to Wootton et al. (2009)**,** developing countries may have a lot to both gain and lose from e-Health applications including Telemedicine. They may gain from providing better access to healthcare services to large, under-served populations. In terms of losses on the other hand, since substantial development in time; effort and needed financial resources to invest in e-Health and Telemedicine infrastructure to the level required to provide healthcare services, are likely to accumulate debts and potentially divert financial resources away from already overstretched conventional healthcare services.

Therefore, a strong argument may be required for the use of Telemedicine projects in developing countries. With more than 80% of the world's population living in developing and the least developed countries, there is a sound case to examine Telemedicine Readiness and e-Health Adoption (Wootton et al., 2009).

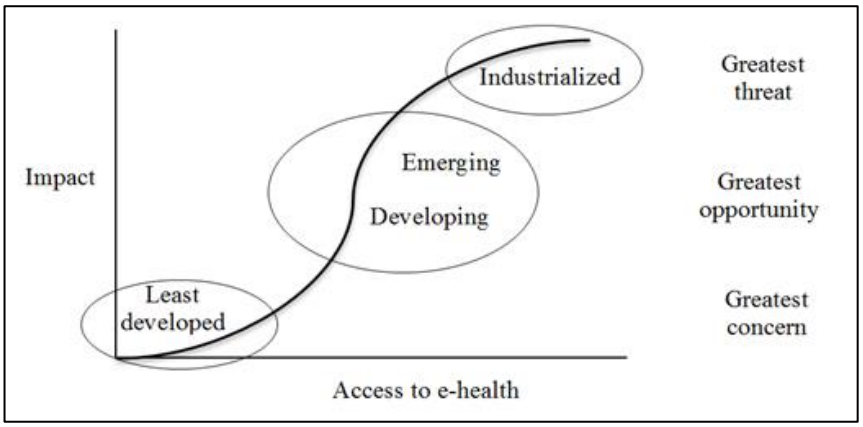


Figure 1.1: Potential impact resulting from access to e-Health applications (Source: Wootton et al. 2009)

Figure 1.1 shows that industrialized countries should integrate e-Health into standing (legacy) healthcare and technology systems, and this may be considered as a risk to conventional healthcare delivery systems. Developing countries present the greatest opportunities to gain from e-Health as these countries lack legacy healthcare systems and could accept e-Health solutions comparatively easily. The opportunities for the least developed countries are a concern and may be excluded from the potential gains of e-Health due to the lack of IT infrastructure (Wootton et al., 2009).

Moreover, a number of recommendations concerning e-Health systems and Telemedicine implementations in the Middle East and North African region were made by the World Health Organization. Specific actions were needed by the member states to address their lack of information and healthcare requirements to include Telemedicine technologies in their overall planning for health development, education, research programmes and telecommunications infrastructure ensuring the development of Telemedicine to be driven by the health needs of people and in accordance with the functional and operational capabilities of healthcare organisations assuring equitable access to all.

Furthermore, these actions should support capacity-building and the transfer of such technologies and knowledge for training and empowerment of individuals and communities (WHO, 1998).

These recommendations should encourage the North African countries and Libya in particular to investigate and study the idea of Telemedicine and e-Health system adoption to deliver better healthcare services nationally as well as to support and accomplish equity of healthcare services for all. Furthermore, the current study might have potential benefits for consideration and adoption of telemedicine solutions into healthcare services in Libya. Implementing such technology will have the possibility of saving many lives, particularly to the people in the underserved, rural areas and patients with chronic diseases. It may further help to improve or reshape the Libyan healthcare system.

Additionally, successful Telemedicine projects implemented in some developed countries such as USA, Australia, Norway and Canada are reassuring to pursue similar projects in developing countries even if they were only deployed in the healthcare private sector for the benefits of all. It may further help to spread awareness and educate people to learn about the potential in healthcare sector, if the information communication technology capabilities were integrated and used.

The above motivations have been further supported by the systemic review by Paré et al. (2007) in which they stated that Tele-monitoring is one of Telemedicine applications, which offers a treatment management technique for chronic disease patients and thanks to producing accurate and reliable data, it provides power to patients, influences their behaviours, and possibly improves their health status.

This study is to research the readiness at an organisational level in Libya to adopt and utilise telemedicine technologies as an added value in order to provide a better accessible healthcare to service users focusing on monitoring health, chronic conditions such as diabetes and high blood pressure in patients.

1.4. Telemedicine Overview

Alajlani and Clarke (2013) stated that Telemedicine has the potential for the Middle East and North African region to deliver healthcare between geographically distanced places by medical professionals being supported by information communication technology. Clinicians and specialists from one site provide diagnosis, treatment, and consultation to patients at a remote site. To be precise, it is the information that is transferred (by telecommunications network), not the healthcare providers or the users of healthcare. The purpose of Telemedicine is meeting the requirements of healthcare consumers or users and it should have the capability to fulfil the needed healthcare requirements. Telemedicine can increase the delivery of healthcare by providing accessibility and increasing staff productivity through reducing the need for patients to travel to see them, improving healthcare provision and patients' outcomes (Alvandi, 2017).

According to Bashshur et al. (2014), the intervention of Telemedicine in managing chronic disease involves patients in their own healthcare, arranges for constant monitoring by their healthcare providers, detects early symptoms, and reacts quickly to warning signs in their illnesses. One of the many Telemedicine solutions is tele-monitoring service.

Tele-monitoring is a checking process of physiological data of a patient, such as weight, glucose level or blood pressure using assistive technology such as a hub connected to a land line or mobile network to transfer the obtained physiological data for an assessment by a healthcare professional for any alarming signs or vital indications of patients' health status. This service could be adjusted to suit the patients' needs such as time and place and could be performed in their home setting without the need to travel to hospital for the physiological data reading to be recorded. Bashshur et al. (2014) in their research of Telemedicine for monitoring into chronic conditions reported that large evidences produced by tele-monitoring researches point to significant benefits using tele-monitoring and that includes reductions in healthcare service usages such as hospital admissions or readmissions, lengthy hospital stays and emergency department visits that typically declined. Tele-monitoring could limit or prevent episodes of disease

severity resulting in improved patients' health outcomes and more importantly reductions in mortalities.

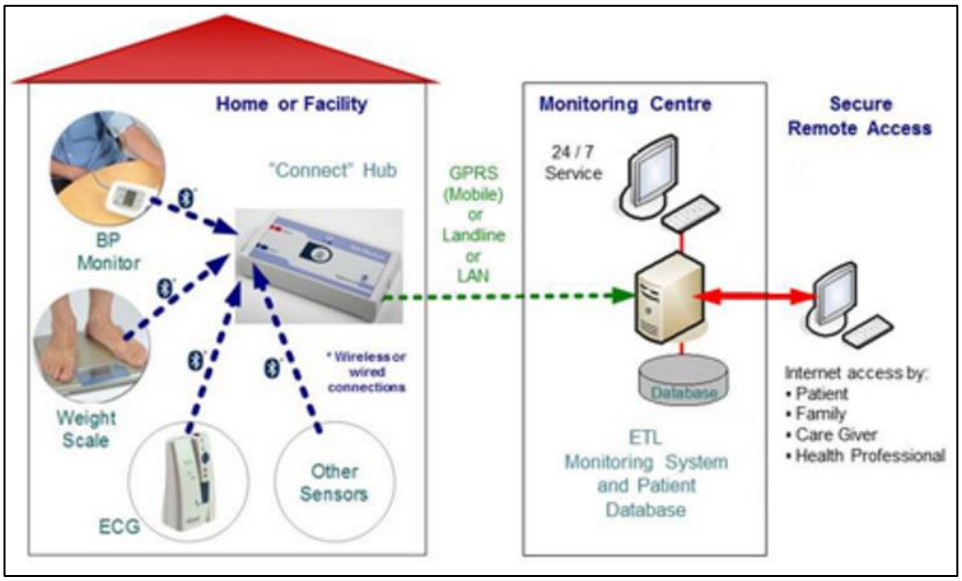


Figure 1.2: Medical Parameter Monitoring system support a review of a range of parameters including: blood pressure (BP), weight, blood glucose, electrocardiography (ECG) and other parameters transferred through General Packet Radio Service (GPRS), Landline or Local Area Network (LAN) to Extract, Transform, Load (ETL) Monitoring System and Patient Database to be accessed via internet by healthcare providers and users. (Source: Elemental Technologies, 2011)

Figure 1.2 shows a straightforward setting of tele-monitoring. If such an example was adopted and implemented in Libya, it may possibly add value to healthcare provision, in general, and it may provide chronic disease patients, in particular, with better healthcare management and better communications with healthcare providers as well as an equal access to healthcare services despite of their locations in Libya's large surface area which means less travel for patients or healthcare providers and less visits to healthcare centres such as hospitals for routine medical examinations.

Bashshur et al. (2014) concluded that "*there is an ever-growing and complex body of empirical evidence that attests to the potential of telemedicine for addressing problems of access to healthcare, quality of healthcare, and healthcare costs in the management of chronic diseases*".

1.5. The Concept of Value Provision in Healthcare

Komashie et al. (2007) argued that there is a distinctive difference between product oriented industries such as manufacturing and service oriented industries such as healthcare. However, their operations have not got such clear characteristics. This is evident in the statement that every industry has certain amount of service provision. This was represented by a model of the product-service arena shown in Figure 1.3.

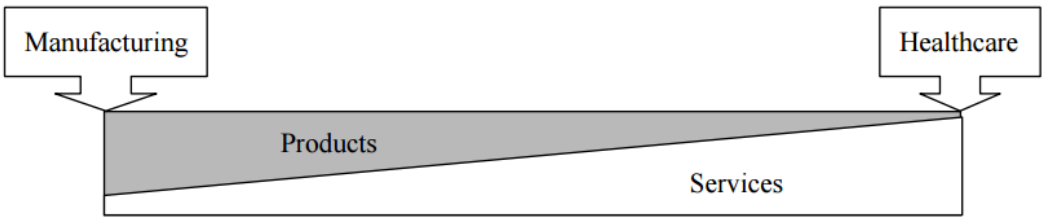


Figure 1.3: The product-service arena (Source: Komashie et al., 2007)

Figure 1.3 shows that the outcome of every organisation or sector would be a combination of services and products subject to where it might be located between the two ends of the arena. However, the shared element between the provision of both products and services is processes (Komashie et al. 2007).

Value creation and provision entails a process that increases the user or the consumer's well-being, such that the user becomes better off in some respect (Grönroos, 2008). Slater and Stanley (1997) describe it as "*being the reason for the organisation's existence and certainly for its success*". Value creation to service users has become a strategic imperative in building and sustaining a competitive advantage (Wang et al., 2004).

Several definitions of value have been introduced in the literature and the most commonly used was offered by Zeithaml (1988) who defined value as "*the service users' overall assessment of the service based on perceptions of what is received and what is given*". Further defined at a rather general level, such as a "*better or easier life for the consumer or user*" (Miller et al., 2002) or "*satisfying consumer or user's needs*". Also, Porter and Teisberg (2006) have defined value in healthcare as "*the health outcome per cost expanded*".

Value is often poorly differentiated from other related constructs such as 'values', 'utility', 'price', and 'quality', and the relationship among them remains largely unclear (Lapierre, Filiatrault, and Chebat, 1999). More quality is a better value, thus quality is a part of overall value. Quality and total price are important elements of value and adjusting them makes it possible for service users to evaluate a service.

Vargo and Lusch (2004) emphasised that services should be viewed as a set of resources and processes with which the organisation searches for creating value propositions. Service users' value propositions are formulated by assessing the current service offerings, identifying what service users want, and then developing solutions that meet the need for a service (Anderson, Narus, and Van Rossum 2006) as shown in Figure 1.4.

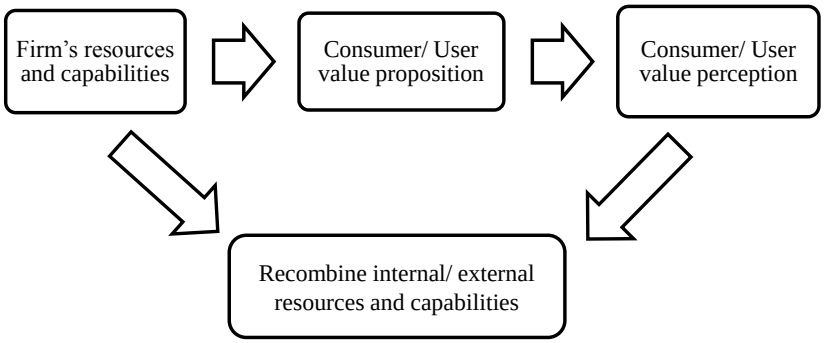


Figure 1.4: Value Creation Strategy Framework (Source: Shanker, 2012)

Payne, et al. (2008) highlighted that it is important that the value proposition exists in order to assist the co-creation of experiences. They continued adding that "*service user value creating processes should not be viewed in the traditional 'engineering' sense, but as dynamic, interactive, non-liner, and often unconscious processes*".

Porter and Teisberg (2006) stated that providing value and improving it has not been the dominant aim of healthcare providers. Instead, the effort has been shifted elsewhere resulting in many strategies, organisational structures, and practices of several actors in the system being misaligned with value for patient. For that reason, value creation utilising Telemedicine technologies to provide to healthcare service users, such as chronic disease patients, is the underpinning theory for the current study.

1.6. Research Aims, Objectives and Research Questions

To assess the concept of Telemedicine Readiness and e-Health Adoption for monitoring patients with chronic conditions in developing countries through a study at an organisational level.

Research objectives

The objectives of this study are:

1. To demonstrate that research into patient monitoring can benefit from examining remote service provision using e-Health strategies from both provider and patient perspective.
2. To ascertain whether sufficient research data can be obtained to provide insights and analysis of Telemedicine monitoring services concerning key aspects of 'remote monitoring centres and technology assessment' and 'associated healthcare perspectives' in order to allow some empirically based conclusions to be drawn.
3. To investigate and, if possible, to develop a conceptual framework for e-Health system adoption and Telemedicine acceptance and the associated organisational capabilities.
4. To attempt to test the conceptual framework by evaluating it in the context of the deployment of applications using value provision concepts or any other method appropriate.

Research Questions

Once the topic of the study has been identified, the researcher's next step is to formulate research questions to achieve the aims of the study. The format and expressing of research questions are closely linked to the research approach that has been chosen. This study is designed to identify and investigate the factors that have impact on Telemedicine Readiness to adopt such technologies in developing countries. Therefore, the following research questions are raised:

RQ1. What are the main organisational factors that might have impact on Telemedicine Readiness in Libya?

RQ2. Which of the outcome measures will influence the acceptance of Telemedicine projects and e-Health systems in Libya?

RQ3. What organisational capabilities and resources affect e-Health adoption in the Libyan healthcare system?

1.7. Thesis Structure

Chapter one is an introductory chapter, which consists of the research background, the research potential, the theory behind it, the aims, objectives and research questions.

Chapter two is a literature review in the area of Telemedicine, Healthcare Provision, Technology Adoption Theories, and Change and Organisational Readiness.

Chapter three introduces the research framework and factors extracted from reviewed literature. This is followed by the development of research hypotheses.

Chapter four reviews research methodologies and approaches for IS systems. It identifies the appropriate ones for this research, in addition to discussing questionnaire design, pilot study, research process, and research ethical procedures.

Chapter five reports survey results of demographic characteristics including gender, age, job roles, experience years, organisation size and ownership type. Furthermore, it reports the influence of the demographic characteristics on the model outputs factors.

Chapter six reports empirical results from model testing, including the reliability test, normality test and all the different tests conducted, such as correlation, factor analysis and regression analysis.

Chapter seven discusses the empirical findings in the context of the existing literature.

Chapter eight reflects on the thesis, describing the key limitations of the work and its contribution for healthcare providers, and it suggests areas for future research.

Chapter Two: Literature Review

The chapter of literature review offers the main parts of researched areas. It starts with Telemedicine and its definitions, related terminologies, history, classifications and origins. After that the focus is on healthcare provision and its challenges in developing countries. It then explores technology adoption and innovation diffusion theories. The chapter further focuses on change and organisational readiness for innovation. The last part of the chapter leads to the Initial thoughts of a conceptual framework which is constructed from factors derived from the reviewed literature.

2.1. The Context of Telemedicine

Healthcare sectors in developing and developed countries are looking at the possibilities and have begun to adopt and incorporate information and communication technologies (ICT) to improve their delivery systems of healthcare services without compromising these services to patients. Similarly, Daw et al. (2016) reported that healthcare organisations undoubtedly have good reasons to consider Telemedicine and e-Health systems in determining the best ways to provide high healthcare service provision under continuous pressures to reduce financial expenses (Mackert et al., 2010; Whitten et al., 2010). Figure 2.1 shows example architecture of ICT for Telehealth.

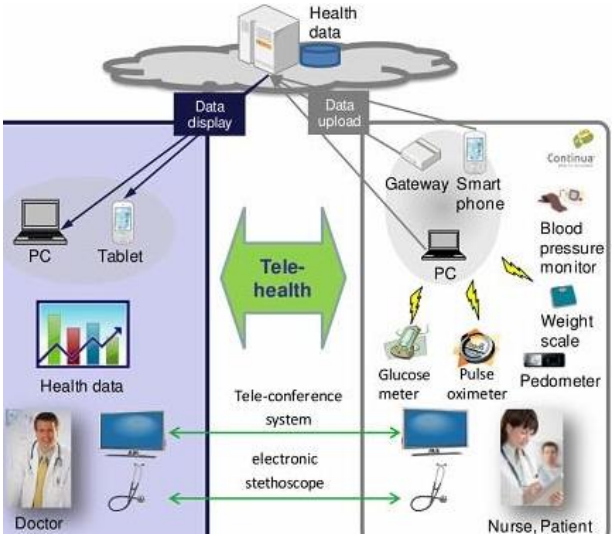


Figure 2.1: Information and Communication Technologies' Architecture for Telehealth (Source: Shams, 2014)

Modern advances in technologies and the growing availability of ICT have been the key driving forces of Telemedicine over a certain period which swiftly brought new

opportunities for healthcare delivery and service (Bashshur et al. 2000). The costs of ICT have also dropped as Telemedicine applications have allowed healthcare organisations to hold vision and execute new and efficient ways of offering healthcare (WHO, 1998). The popularisation and introduction of the internet has highly enhanced the advancement of ICT, along with increasing Telemedicine scope for encompassing web-based applications. These applications include email, conferences, tele-consultation via the internet and video or digital imagery through multimedia approaches.

On the other hand, in developing countries, limitations in healthcare IT infrastructure and hospital IS capabilities are not often allowing them to take advantage of the latest advancement of ICT. Ahwidy and Pemberton (2017) found in their research that Telemedicine technologies in the Libyan Healthcare System are inadequate and that there is insufficient support for IT or even ICT training for healthcare personnel. In order for Telemedicine to be adopted by the Libyan Healthcare System, a specific Telemedicine framework needs to be developed to address these concerns.

2.1.1. Telemedicine's Definitions

Telemedicine, according to Field (1996), covers both clinical and non-clinical applications of Telemedicine. Clinical applications of Telemedicine contain patient care, including diagnostic, treatment and other medical services for patients. Non-clinical uses of Telemedicine, include continuing medical education and management which does not involve decisions about patients' care (Field, 1996). In addition to this, El Taguri et al. (2008) stated that the World Health Organisation (WHO) reported in its global observatory for e-Health series (WHO, 2010) that Telemedicine, a term created in the 1970s, which literally means healing at a distance, signifies the use of information communication technology to improve patient outcomes by increasing access to healthcare.

Researchers argued that there was not any particular definition of Telemedicine as found by Sood et al. (2007) in their study which researched 104 peer reviewed papers for the meaning of this term. The Sood et al (2007) research covers a period between 1970 to 2006 and this duration is too long for the terms to come to its full meaning as the technology has evolved dramatically and its usage has advanced so rapidly.

Furthermore, the article did not indicate what keywords were used in the search of the term Telemedicine as some studies and organisations are using different terminologies and the meanings might be the same. Table 2.1 shows Telemedicine definitions by different scholars.

Table 2.1: Telemedicine definitions as viewed by different researchers

Definitions	References
Telemedicine is the practice of medicine without the usual physician-patient confrontation via an interactive audio-video communications system.	Bird, 1971
An integrated system of healthcare delivery that employs telecommunications and computer technology as substitute for face to face contact between provider and client.	Bashshur, 1995
Telemedicine is the delivery of health services when there is geographical separation between healthcare provider and patient, or between healthcare professionals.	Miller, 2001
Telemedicine is the provision of healthcare services, clinical information, and education over a distance using telecommunication technology.	Maheu, M. at al., 2001
Exchange of medical information from one site to another via electronic communications for the health and education of the patient or healthcare provider and the purpose of improving patient care.	Demiris, G., 2003
Use of ICT to overcome geographical barriers and increase access to healthcare services.	Alajlani and Clarke, 2013

In this research, the term Telemedicine is intended to describe the use of ICT advancements along with adopting innovation theories within healthcare organisations in order to add value and provide healthcare services to patients with chronic diseases. This could make healthcare available to more disadvantaged patients in remote locations as this technology might improve the distribution of healthcare services and it may further improve the patient's care and safety by connecting healthcare personnel working in separate medical units from the diagnosis stages through to follow-up and patient management.

2.1.2. Terminologies Associated with Telemedicine

Eysenbach (2001) defined e-Health as a developing area between informatics, healthcare and business, referring to healthcare provision services delivered through ICT. As per the study of Craig and Patterson (2005), Telecare is interrelated to Telemedicine and refers to the healthcare provision of nursing and care to a patient at distance. Similarly, Telehealth refers to healthcare provided at distance to people who are not necessarily unwell, but who wish to remain well and independent. Figure 2.2 illustrates the subdivisions of e-Health, with respect to Telehealth, Telecare and Telemedicine.

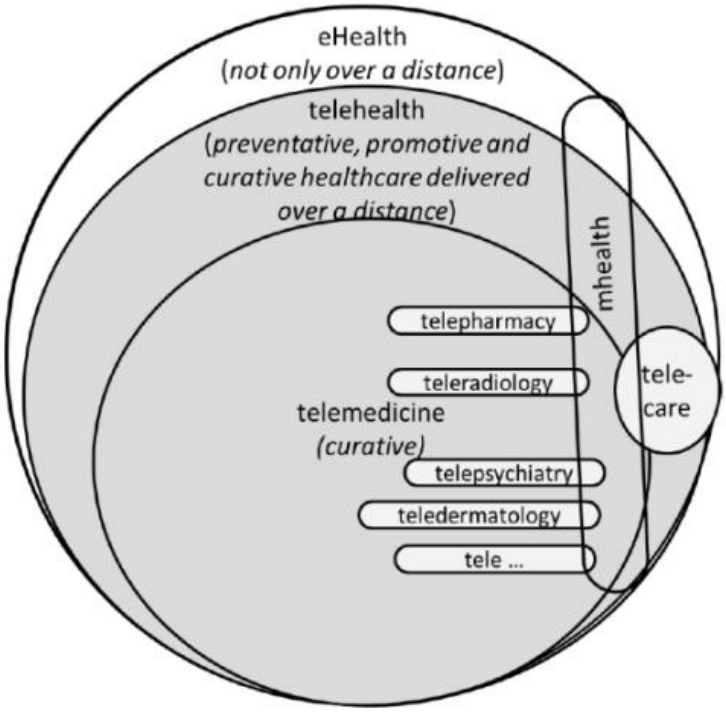


Figure 2.2: Terminologies Associated with Telemedicine (Lagasse, 2016)

It has been highlighted that Telemedicine's relation with Telehealth is seen as Telemedicine being a subset of Telehealth (Sood et al, 2007). The differences of Telemedicine, Telecare and Telehealth are still under discussion; however, they have one element in common that all involve the transmission of health-related information between locations in order to keep individuals in a better health condition (Craig and Patterson, 2005).

The data transfer or retrieval from local database for medical reasons to direct assistance at patients in their home through remote monitoring services may be divided into two groups:

a) **Telecare** which is defined by the Department of Health (2011) in England as a service that uses a combination of alarms, sensors and other equipment to help people to remain safe and independent in their own home for longer. This is done by monitoring activity changes over time and will raise a call for help in emergency situations (Department of Health - NHS, 2011).

b) **Telehealth** is defined by the Department of Health (2011) as a service that uses equipment to monitor people's vital health signs such as weight, blood oxygen levels or blood pressure in their own home. This service would reduce frequent visits by the patients to medical centres as those vital health signs would normally be measured by healthcare professionals. It may further reduce unplanned hospital admissions through identifying any changes in peoples' health conditions before any issues become serious to initiate emergency response.

Telecare usage appears to have changed over the years, mainly as a social care service whereas Telehealth is a more innovative tool used essentially to monitor important signs in patients with chronic diseases such high blood pressure and sugar level. Figure 2.3 shows a broad use of Telecare and Telehealth.

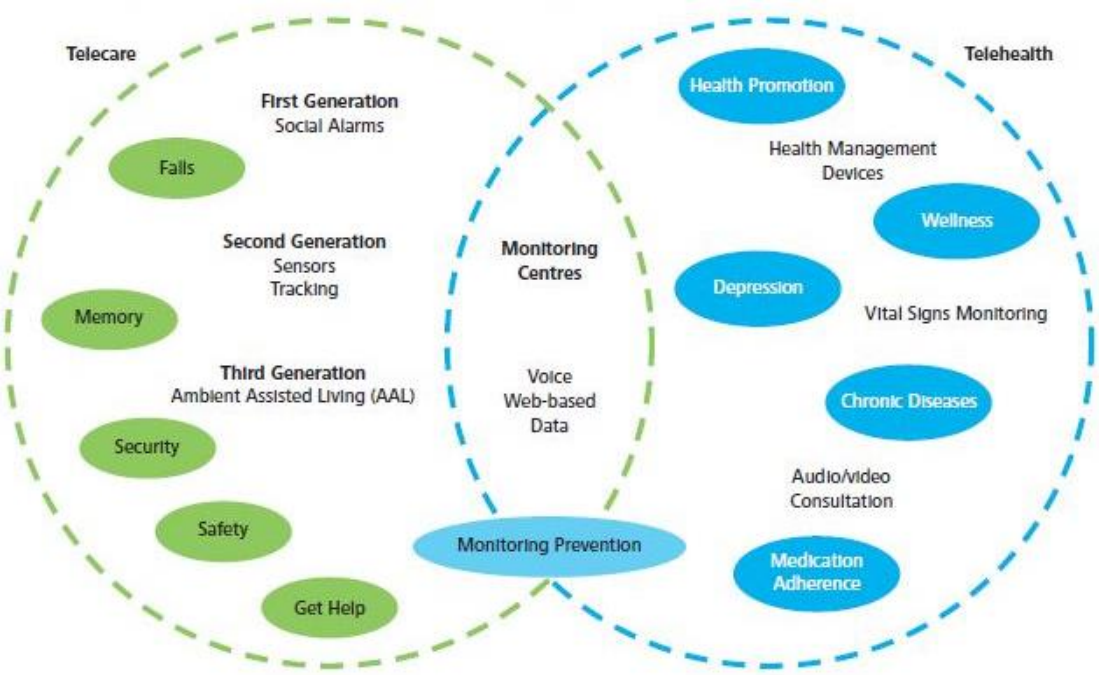


Figure 2.3: Usage of Telecare and Telehealth (Source: Deloitte Life Sciences & Healthcare Group, 2012)

Historically, the term Telemedicine can be found from the middle of late nineteenth century. However, it was first published in the twentieth century when electrocardiograph data were being transferred over telephone wires. In the early 1960s, Telemedicine was used by space technology and military sectors (Bashshur et al. 2000). Table 2.2 summarizes 3 different terminologies associated with Telemedicine and their definitions by various scholars.

Table 2.2: Terminologies associated with Telemedicine

Term	Definitions	References
e-Health	The transfer and delivery of healthcare by electronic means.	WHO, 1998
Telehealth	The use of ICT to monitor patients remotely to allow them to live safely and independently.	Alvarez et al., 2011
Telecare	Remote support services such as alarms or fall detectors.	Greenhalgh et al., 2013

2.1.3. Telemedicine Taxonomy

According to Tulu et al. (2007), taxonomy is the theoretical research of category. It is a multistep process, such as the growth of a category plan and dedication of the category requirements in regards to clearly demonstrable functions based on concept or experience. World Health Organisation classified Telemedicine into two types: Store-and-forward (asynchronous) and real time (synchronous). This classification is based on the timing of the transmitted information and the interaction between the individuals such as health professional and patient. The store-and-forward type involves the transfer of recorded data between individuals to be reviewed at different time of their convenient. However, the real time type involves the individuals to be present for live transfer of health information such as consultation by live videoconferencing. In both types, health information might be transferred in a range of media such as emails, video, or images (WHO 2010). Figure 2.4 illustrates WHO's classification of synchronous and asynchronous Telemedicine.

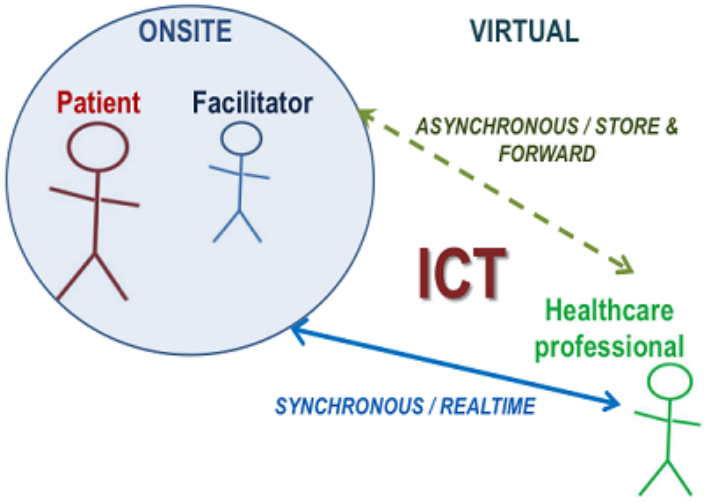


Figure 2.4: WHO's Classification of Telemedicine (Source: Swanepoel, 2013)

Tulu et al, (2007) said that Telemedicine was inspired by the demand to proof its efficiency, and therefore, concentrated on creating a way to assess Telemedicine programs and their effects on quality, availability, or cost of healthcare.

One attempt is the study of Bashshur et al. (2005) which introduced a model illustrating three dimensions as shown in Figure 2.5.

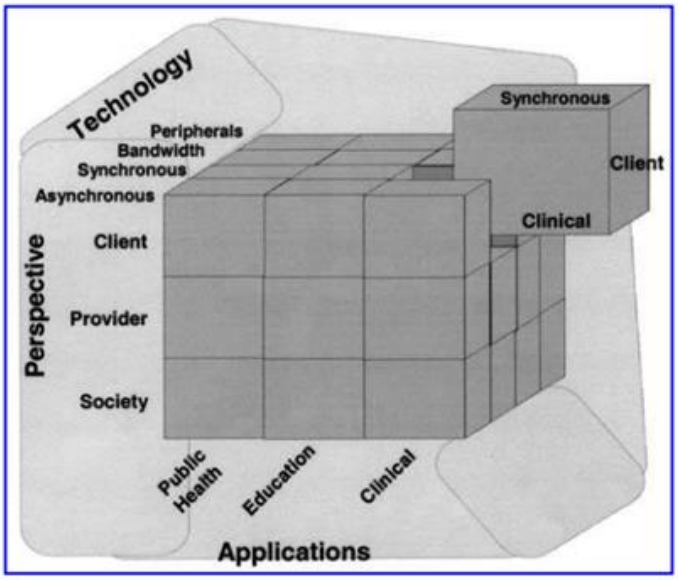


Figure 2.5: Three-dimensional model for Telemedicine evaluation (Source: Bashshur et al, 2005)

Bashshur et al. (2005) explained that the applications dimension in the model include clinical practice as well as medical education and public health. Through the perspective dimension, an evaluation could be conducted involving clients, providers, and society at large. Each perspective must be evaluated separately such as the question on cost - healthcare users could be interested in the cost of technology, whereas providers might be interested in return on investment. Social interest could include access to healthcare services and meeting the needs of the society. The technology dimension characterises systems and configurations in use, including synchronous, asynchronous, transmission by wired or wireless connections, bandwidth size and devices for diagnosis and treatment.

In Figure 2.6 Tulu et al. (2007) proposed a new three-dimensions model representing medical, delivery and organisation dimensions. Every dimension has sub-dimensions, which enables the categorisation of various Telemedicine projects.

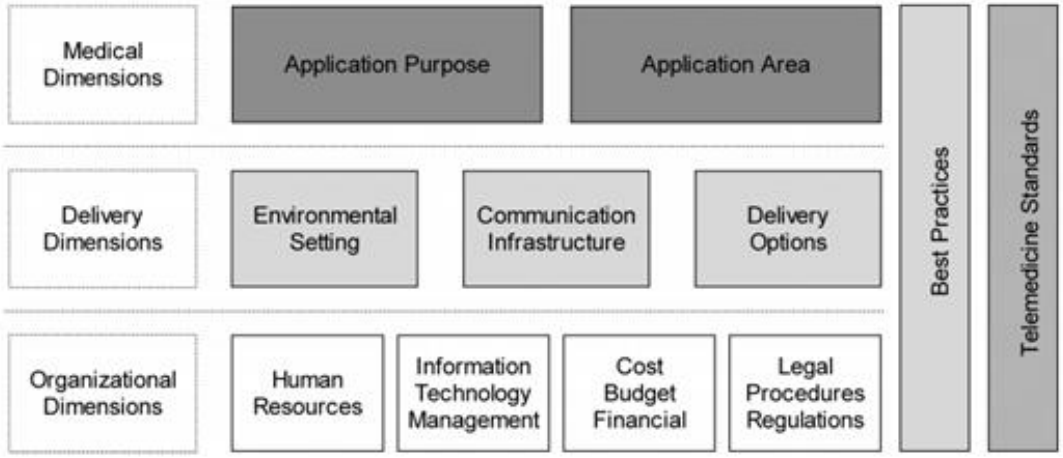


Figure 2.6: New Three-Dimension Model (Source: Tulu et al, 2007)

Tulu et al. (2007) explained that in the medical dimension, application purpose and application area (domain) are the two sub-dimensions. Application purpose is the cause for a Telemedicine intervention which can be clinical or non-clinical. Telemedicine clinical intervention could include monitoring, healthcare nursing, primary evaluations and second opinion consultation. Non-clinical Telemedicine intervention could involve management or administration, learning, or act for research reasons.

The application purpose defines part of the requirements for the delivery dimension. Furthermore, application area (otherwise termed as "medical domain") could affect the delivery requirements. Radiology and Psychiatry have different methods of providing healthcare services. Consequently, medical domains driven by requirements should be studied before choosing a provision alternative of Telemedicine intervention.

Once the upper level dimension needs have been determined, the next stage is to assess the delivery dimension, which will substitute the face-to-face delivery choice (Tulu et al., 2007). The three sub-dimensions of delivery dimension are: environmental setting, communication infrastructure and delivery options. Environmental setting points to the locations, such as home setting and hospital setting, where the Telemedicine session is taking place between the two ends which are expected to be using Telemedicine intervention. These physical locations should be studied before choosing the related communication infrastructure and delivery options. Communication infrastructure points to the different ways that are available for communicating medical data or medical information in any format.

Delivery options to conduct Telemedicine could be real-time or store-and-forward type, audio or text built. Choosing a delivery option is the key to fulfil the requirements of the application purpose in a particular medical domain (Tulu et al., 2007).

The four sub-dimensions of the organisational factors are: human resources, IT management, cost and legal procedures. Both committed human resources for Telemedicine intervention and existing information technology management have to be in place to make Telemedicine implementations successful. Telemedicine is a technology intensive project and it needs participation of all stakeholders at the planning phase. Funding issues, services cost, and financial concerns for implementing such projects have to be taken into account. Lastly, regulations and legal procedures have to be considered, and any concerns related to Telemedicine healthcare provision services have to be established (Tulu et al., 2007).

LeRouge et al. (2002) advocated that Telemedicine classification helps researchers to gather information for identifying the best practices in the Telemedicine field. Tulu et al. (2007) said that the best approaches will have an effect on the progress and preparation of new Telemedicine projects. Once each category gets to a level of maturity, the principles will progress from the learned exercises by best methods, and these principles will lead upcoming Telemedicine projects.

From the literature reviewed in the current section, Telemedicine has different dimensions to be considered, if this technology is to be adopted into the Libyan healthcare system. These dimensions include the purpose of such application which could be a better access to healthcare for rural areas and underserved population. Furthermore, it includes organisational dimensions such as human resources, IT infrastructure and learning capabilities from previous Telemedicine projects in developed countries.

2.1.4. Telemedicine Origins in Developed Countries

The recent advances of satellite communications and mobile networks have prompted Telemedicine projects (Craig and Patterson, 2005). As per the study of Bashshur et al. (2003), Telemedicine activities have expanded in developed countries. According to the research of Glascock and Kutzik (2000), Telemedicine activities in the USA have tripled previously, particularly in emergency medicine practitioners and mental health specialists and have grown in two key areas throughout the 1990s: rural and prison Telemedicine (Darkins and Cary 2000). In addition to that, Telemedicine consultation has doubled (Bashshur et al, 2000).

In prison Telemedicine, the consultations supported improving the quality of life and saving the costs of transportation. The USA's prison population rises by 8-9 percent per annum (Darkins and Cary 2000). The prison system of Texas allows inmates to have access to both primary and special care with community standards. It has been observed that Telemedicine plays a role in saving transport bills when transferring prisoners to receive medical care. On the other hand, rural Telemedicine was funded by grants or by healthcare institutions between 1990 and 1995 (Darkins and Cary 2000). Rural Telemedicine was designed to support healthcare in rural areas where provision was insufficient (Glascock and Kutzik, 2000). The major consultation in rural areas is given in the fields of cardiology, radiology, and orthopaedics. Table 2.3 below presents the percentage of five purposes for deploying tele-consultation in the USA (Darkins and Cary 2000).

Table 2.3: Deployment purposes for tele-consultation in USA during 1996

Specialty for Consultation	Percentage
Mental health	21
Accident and emergency	16
Cardiology	12
Dermatology	11
Surgery	8

According to Healthcare Intelligence Network (HIN) in their 2013 survey, healthcare in the USA was orientated toward videoconferencing more than monitoring discharged patients, conducting remote consultations and facilitating communication. Furthermore, the survey pointed out that videoconferencing has become the number one technology used as it has increased from 41% in 2010 to 59% in 2013 (HIN, 2013).

The HIN (2013) further reported that there is a growth in health conditions monitored remotely as 100% of respondents from the survey, whose weight and vital signs were monitored, increased by 79% respectively in 2010. The three top remotely monitored health conditions have remained unchanged since 2010: heart failure, chronic obstructive pulmonary disease (COPD) and diabetes. Figure 2.7 shows the top barriers to implementing Telemedicine in the USA (HIN, 2013).

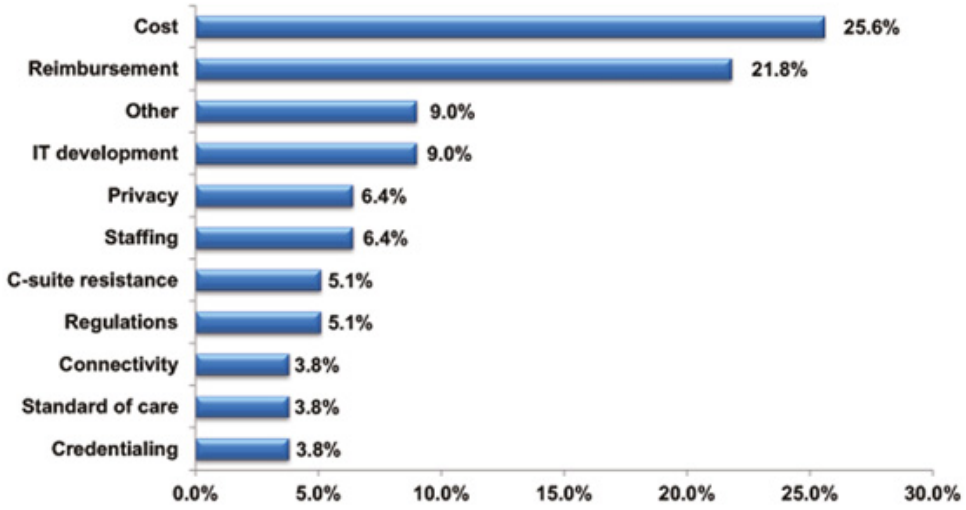


Figure 2.7: Top barriers to Telemedicine (Source: HIN, 2013)

The Australian healthcare sector has met with several challenges that have usually become the key reason for access of specialist services in regional and rural communities. The choices of healthcare for patients in both regional and rural areas are limited, especially for patients having chronic or acute illnesses (Smith, 2004). Access issues have increased when communities dispersed into many areas in which Queensland is a significant example (Smith and Gray, 2009). Queensland is the second biggest state in Australia and has healthcare access and management issues. Service users and medical staff have to travel to central healthcare institutions or clinics in major cities for periods of one to two days and then go back to reach regional healthcare centres. These travel durations cost valuable time to most clinicians and other medical staff and healthcare users (Smith, 2004).

Additionally, Telemedicine programmes in Australia have limitations associated to funding (Smith, 2004). The funding from the Australian government supports maintenance and purchase of Telemedicine infrastructure that leaves less investment to operational expenses and service evaluation (Smith, 2004).

Standing and Hampson (2015) reported that the UK is well situated in many foundations of e-Health and has the potential to develop into a world front-runner in this sector. However, there are a number of complications consisting of shortages of IT and analytical capabilities, and complications in financing. The government also plays a key part in supplying the facilities, such as regulating frameworks and information management, to back up development of the area.

In developing countries, Telemedicine projects are given less consideration probably due to lack of funds, awareness of such alternative healthcare services or limited IT infrastructure within healthcare organisations or across the country. Telemedicine projects in developing countries should place emphasis on organisational factors as well as that specific country's cultural and economic factors. Nakkas et al. (2015) in their structured literature review study found that there are almost no empirical researches that show the present position of Telemedicine in developing countries especially in the North African region. They further found that no study has been conducted to report the Libyan status in regard to Telemedicine. Similarly, in this this study it was found that there is little literature on Telemedicine or eHealth subjects in Libya and these are shown in Table 2.4.

Table 2.4: Literature review of most Telemedicine and eHealth studies on Libya

Purpose of Research	Reference
Telemedicine Awareness	El Gatit et al., 2008; Khalil and Jones, 2007; Chorin, 2014.
eHealth Assessment	Sweisi, 2010; Sharif and Masood, 2014; Ahwidy and Pemberton, 2017; De la Torre et al., 2018.
Implementation Factors	Nakkas et al., 2015.

2.2. Healthcare Provision

Huber et al. (2011) defined health as the mental, physical and social well-being that relates to disease or illness. Maintaining the provision of healthcare is one of the important aspects that are considered in today's competitive environment of healthcare systems. Spencer and Walshe (2009) define healthcare provision as the enabling of hospitals that deal with the varied legislation and patients' demand under the healthcare linkage. It is further stated by Komashie et al (2007) that the hospitals which are responsive enough are the ones that are open to change for meeting the obligations of the environmental conditions.

According to Harvard's Professor Michael Porter (2010) healthcare's stakeholders often have inconsistent objectives, such as accessibility to services, productivity, upper quality, cost containment, safety, comfort, patient-centeredness, and fulfilment. Accomplishing upper quality for healthcare users should become the overarching purpose of medical care provision. He further states that value should always be described around the healthcare users, and in a well-performing medical care program, the development of value for healthcare users must decide the benefits for all other stakeholders in the system.

A simple economic analysis of healthcare services is the law of supply and demand which highlights the importance of resources allocation. The price is the revenue to provide services as well as the marker to show, if there is a surplus or shortage. When the price of a service is free to the service users, then the demand will be at its maximum. However, with limited resources, the supply will only be that high, if the price itself tends to be unlimited (Krugman, 2014). Figure 2.8 illustrates the supply and demand curves for a given service.

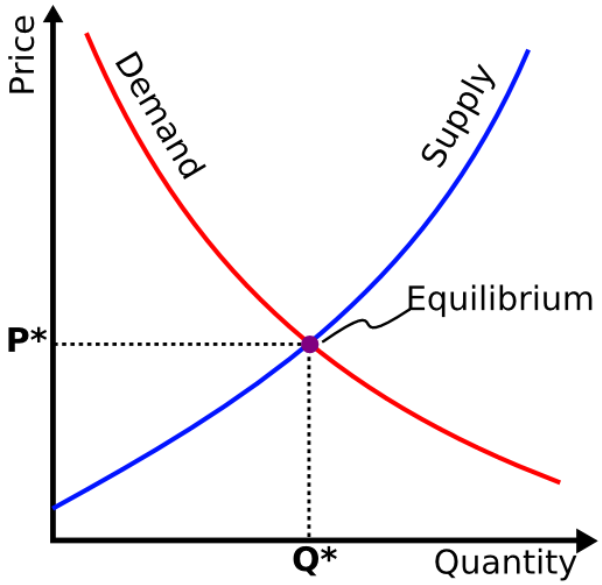


Figure 2.8.: Supply and demand curves (Source: Healthcare economics, 2014)

The economic factor is only one of several factors which might hinder the implementation of Telemedicine in developing countries. According to Paim et al. (2011) and many researchers, in order to provide healthcare services to patients or users, healthcare systems should mitigate the challenges and barriers with which they are being confronted. Table 2.5 shows the main barriers which were emphasized by various scholars.

Table 2.5: Telemedicine main challenges and barriers

Barriers	Reference
Economic factors	Sanders and Bashshur, 1995; Wootton et al., 2005; WHO, 2010; LeRouge et al., 2010; Wamala and Augustine, 2013; Weinstein et al.,2014.
Ethical and legal factors	Sanders and Bashshur, 1995; WHO, 1997; Khan et al., 2007; Wamala and Augustine, 2013.
Infrastructure and technical factors	Martinez et al., 2004; Call et al., 2015
Organisational factors such as human resources and learning	Bashshur, 1995; Sanders and Bashshur, 1995; Wootton et al., 2005; Jennett et al., 2009; Alajlani and Clarke, 2013; Call et al., 2015.

In this research, the barriers and challenges were divided into two categories based on healthcare users' (patients, carers and providers) interest and objectives. The first group is the healthcare providers (the system) and the second group the healthcare users (patients and carers). Each one is a stakeholder and might have different determinations when they are using the healthcare system, and if these different factors are not taken into consideration, it might delay the implementation or the use of Telemedicine technologies. Barriers and challenges included in this study were gathered from the literature review and from participants during the pilot study stage.

2.2.1. Healthcare System Challenges

The healthcare system has the primary objective of providing timely and effective healthcare services to patients. Van Olmen et al (2010) consider that the delivery of healthcare services and the organisation are the fundamental processes and the direct outputs of the healthcare system (HS) model as being shown in Figure 2.9. This model is relying on managerial and organisational attention taking into account other stakeholders such as the population. However, the generic nature of its form to allocate and manage resources in order to improve health outcomes does not put the patients or their carer to be in the centre of healthcare services nor does it consider technology advances alignment to support conventional healthcare delivery services. Furthermore, due to its limitation, the model is constrained within developed countries and should be tested in developing countries as it relies on public domain (cultural domination).

Healthcare systems in developing countries are seen as being unable to cope with various challenges and their weaknesses are considered to be a key issue to overcome the increasing problems of chronic conditions within the population. There is a need for more studies on healthcare systems in developing countries to identify main factors affecting healthcare systems in those countries.

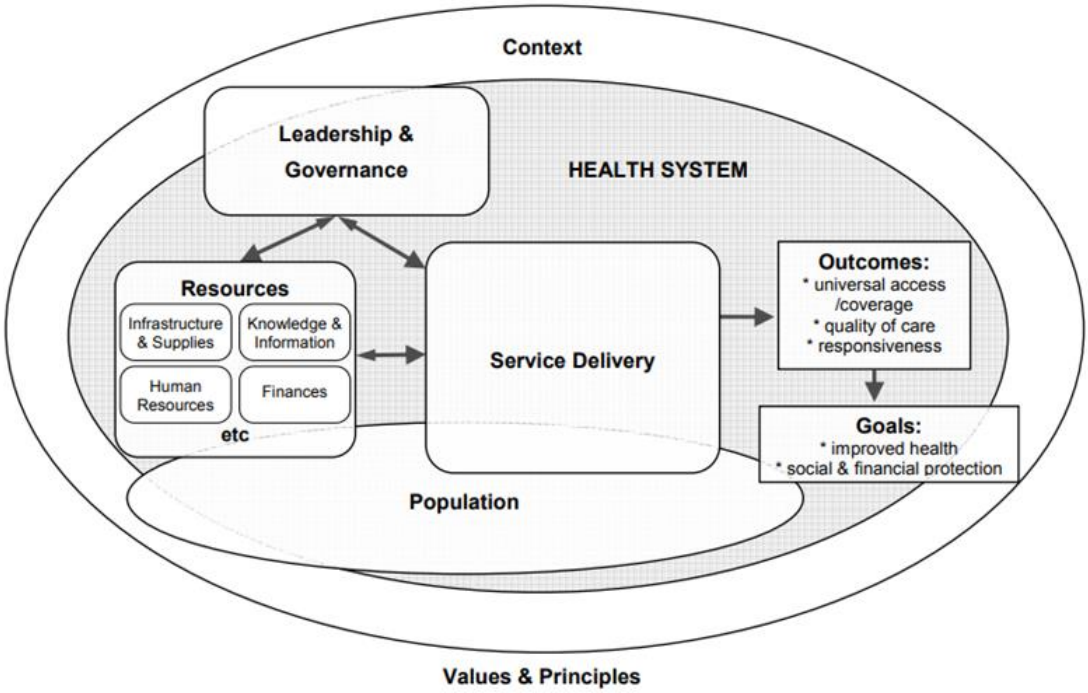


Figure 2.9: Healthcare framework in generic form (Source: Van Olmen et al., 2010)

The challenges that healthcare systems are facing (focusing on developing countries such as Libya) in providing effective and timely treatment to patients include but are not limited to the following:

Lack of timely availability of healthcare staff

The research of Benamer et al. (2009), highlighted that it is compulsory that at the time when the patient is in a critical condition and needs urgent treatment, the healthcare staff such as clinicians should be available when and where they are needed. Therefore, the healthcare system faces the challenge of not providing timely treatment to all patients because of the lack of healthcare staff availability. The availability of the clinicians and other medical staff is essential in the healthcare system (Steinbrook, 2009).

Technology challenge

According to Lluch (2011), most of the healthcare systems in Africa are facing a technology challenge because the healthcare centres are not well equipped. Less than half of the population of the North Africa have access to healthcare centres with modern equipped technology. The use of latest technology has progressively become crucial in providing effective treatment.

Staff shortage

Steinbrook (2009) highlighted in his research that there is a shortage of skilled and experienced staff that could help patients by providing immediate guidance in case of emergency. Many patients in Libya have reportedly died because of this problem (Daw and Elkhammas, 2008). Telemedicine technologies could help avoid these issues; however staff with IT skills will be needed more than before to facilitate communications between patients and healthcare providers.

Increasing population

Globally, the population is increasing day by day, including in the North Africa and Libya as well which means that the number of patients increases, too, and providing effective and timely treatment at the same time is an immense challenge for the healthcare systems (De Souza and Pidd, 2011).

Setting policy, legislations and protocols

Healthcare organisations should be informed of the directional tone of national policy in conducting healthcare provision through a bundle of policy and legislation, generalised pronouncements of best practices from healthcare governing bodies, and guidelines from quality standard organisations (WHO, 1998). If Telemedicine were to be adopted in Libya at this time, it would be lacking in these aspects, and this should be considered by policy makers and others.

As per the research of Paim et al. (2011), these issues and challenges have significantly affected the performance of the healthcare organisations to provide their best services to patients. According to the research of Lluch (2011), predicting the future scenario of the healthcare systems, these challenges could have a further negative impact due to the new setup of technology and advanced healthcare delivery option, and health issues in society at large could be difficult to be managed and handled appropriately by healthcare providers.

2.2.2. Difficulties for Healthcare Users

Based on the research of Schiavolin et al. (2013), there are some difficulties that patients may encounter while using healthcare services. Peters et al (2008) studied factors affecting the quality of healthcare delivery in developing countries. These factors included accessibility to healthcare, its availability and financial issues. Other factors affecting patients using the Libyan healthcare system are lack of awareness, patient's safety, medical and administration mistakes - all of which were discussed with clinicians who were attending and participating in a conference in 2014 organised by the Libyan Embassy in London (Libya Higher Education Forum, 2014). This issue is less problematic in Libyan major hospitals and cities. Some of these are discussed (with the focus on developing countries) but not limited to the following:

Access to healthcare services

Healthcare systems in developing countries are confronted with constant challenges of fulfilling the population's needs especially to the most disadvantaged healthcare users due to their remote location far from healthcare services or due to their old age or health conditions which prevent them from travelling to healthcare providers. Balarajan et al (2011) examined several factors that might impact equity in access to healthcare users through interconnected demand-supply framework for healthcare services shown in Figure 2.10.

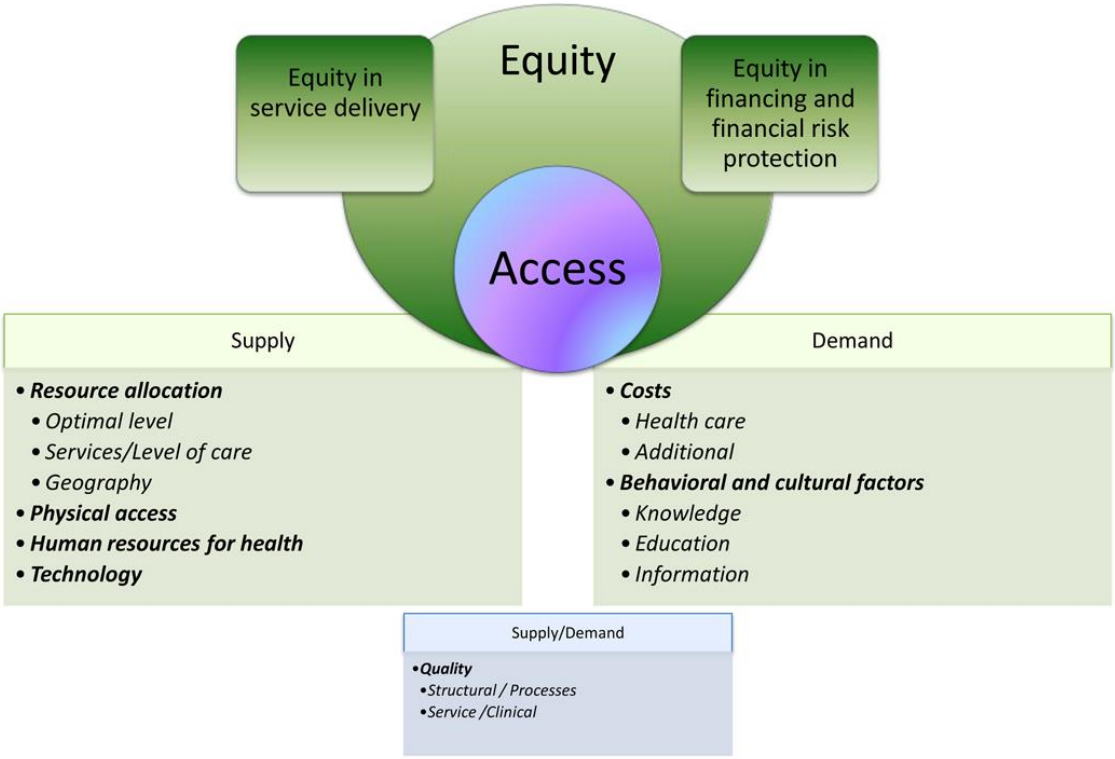


Figure 2.10: Framework of challenges to access in healthcare services (Source: Balarajan et al, 2011)

Lack of awareness

Graham (2008) pointed out that healthcare service users in developing countries (such as Libya) may not have sufficient information regarding the diseases with which they are diagnosed. They may further not have available treatments or treatment management to suppress these diseases, as their ambitions increase with their income, and after basic needs are met, their well-being becomes highly regarded. Therefore, they may find using the healthcare services difficult when they visit the healthcare centres, as they are not provided with any information about their disease or relevant instructions on which department to consult. This adds an unpleasant experience alongside their medical problems.

No supervision of healthcare staff

Theron and Rout (2013) indicated that little or no supervision of healthcare staff is a common problem faced by the patients in healthcare centres in developing countries. Healthcare staff working without direct support and supervision, and their limited experience might cause medical complications and in some cases lead to mortality. While no specific regulations govern the supervision, such support and supervision is necessary (Lamacraft et al., 2008).

Insufficient resources

Healthcare providers are increasingly under-resourced due to the global downturn in government social spending, health sector privatisation, and aging populations (Brear, 2006).

Management issues

Healthcare providers tend to be highly task-oriented, labour intensive, and dependent on interdisciplinary teamwork, so the influence of organisational factors within them may differ considerably from the business settings which have traditionally been studied (Chau and Hu, 2001). For patient safety, Musson and Helmreich (2004) recommended that healthcare organisations should focus on and prioritise team training and resource management programs in medical settings as well as develop leadership and involvement of clinicians to gain their support for any innovation projects as their medical background could help to play a critical part in improving safety of healthcare provision. Therefore, management issues may arise when implementing Telemedicine and these issues might affect the patient's course of diagnosis and treatment.

2.2.3. Telemedicine in North Africa

According to Wamala and Augustine (2013), Africa falls behind in communication and information technologies' infrastructure as few efforts have been made for the successful solution in terms of Telemedicine. Various researchers have praised the internet for Telemedicine as a revolutionary tool that allows significant transfer of information (De la Torre et al, 2018; Okoroafor et al, 2016).

Montana Health-care Solutions Pvt Limited and Robertson Global Health Solutions Corporation have facilitated signing an agreement with Africa for Telemedicine to offer cost effective and high quality healthcare services (Wamala and Augustine, 2013). In recent times, only a few regions in Africa have been able to have Telemedicine technology (Chorin, 2014).

FOMTA "Fundamental of modern telemedicine for Africa" is another Telemedicine project aimed at promoting indigenous development in regional networks between research centres in the developing countries and their respective universities linking them to European countries (Wamala and Augustine, 2013). Additionally, RAFT (Reseauen Africue Francophone pour la Telemedicine – translated into English as "Francophone Network in Africa for Telemedicine") and Pan-African e-network project are other Telemedicine projects in Africa. Research reveals that the project of Pan African e- network is significant for providing Telemedicine and distance education in Africa that resulted in firm partnership between Africa and India (Wamala and Augustine, 2013).

In some countries such as Ethiopia and South Africa there is significant progress in Telemedicine projects, while in countries such as Burkina Faso and Nigeria the progress is slow due to lack of support by policy makers (Al-Shorbaji et al, 2018; Gulube and Wynchank, 2001). In Nigeria, efforts are underway to design and implement Telemedicine infrastructure. However, some negative factors exist, one of these is limited computer literacy among the many already long serving professionals, another is poor financial budget allocation to Ministries of Health (Wamala and Augustine, 2013).

Telemedicine in Africa might potentially be a suitable delivery option of healthcare provision considering the continent's limited resources such as human resource especially in healthcare sector.

2.2.4. Current Initiative of Telemedicine and e-Health Systems in Libya

Concentrating on investments in e-Health systems and Telemedicine technologies will support the distribution of patient-centred data through organisations internally and externally (De la Torre Diez et al, 2018). Libya is one of the significant countries in Africa that have much improved in the field of technology infrastructure including mobile communication networks and has further improved in the area of health in terms of numbers and high quality healthcare personnel achieved through an excellent education system (Wamala and Augustine, 2013). These two elements should help in the adoption and implementation of Telemedicine projects.

El Gatit et al. (2008) in their survey of 41 Libyan clinicians studying their perception and knowledge of Telemedicine, reported positive response towards the use of Telemedicine among clinicians once they have been made aware of such technology and way of healthcare delivery. Although the sample size is fairly small, to some degree the results indicate the readiness of Libyan clinicians to utilise Telemedicine, if it was implemented. Table 2.6 below presents the percentage of the participants' perception of Telemedicine before and after they have been made aware of the technology.

Table 2.6: Libyan clinicians' perception of Telemedicine (El Gatit et al, 2008)

Perception of Telemedicine **(n = 41)**	Before		After	
	No.	%	No.	%
Understanding				
Excellent	3	7.3	16	39
Fair	10	24.4	20	48.8
Confused	22	53.7	5	12.2
Unaware	6	14.6	0	-
Attitude to introduction				
Agree	2	4.9	40	97.6
Disagree	39	95.1	1	2.4

In this research, it has been noted that some steps were taken to increase the current initiatives to use Telemedicine in Libya including advanced Intensive Care Unit using Telemedicine services. It does not only reduce mortality rate, but also operates and manages patients efficiently. Different types of Telemedicine programs contribute to dealing with patients and are used in humanitarian based needs at different levels of disasters. According to El Taguri et al. (2018), wireless Telemedicine services are considered as opportunities realised by the Libyan government. Nakkas et al. (2015) reported that the increased use of mobile phone services provides better healthcare services to patients in Libya. As El Taguri et al. (2018) highlighted the increased demand of e-application for health services and similar Telemedicine initiatives are starting to arise in Libya. Finding an ideal Telemedicine model in Libya begins with covering the needs of Telemedicine service through appropriate policies. With these initiatives, the Libyan National Health Services are experiencing areas of weaknesses that failed to properly use any Telemedicine projects in the department of health at the national and regional level. However, according to Daw et al. (2016) there is little information in the literature regarding the use of Telemedicine and e-Health systems in Libya and this suggests the need to assess the readiness to adopt and eventually implement and sustain Telemedicine technologies and e-Health systems. Similarly, Jahangirian, M. and Taylor, S. J. E. (2015) found that e-Health projects could be started in Libya where the use of mobile phones exceed 90 percent of the population, however the rate of Telemedicine projects are still very low as illustrated in Figure 2.11. Additionally, Telemedicine solutions, such as electronic medical records, are not yet applied in Libya's health establishments. These would improve coordination of clinicians, reduce inefficiency, increase effectiveness and overall quality, and improve safety (WHO, 2007).

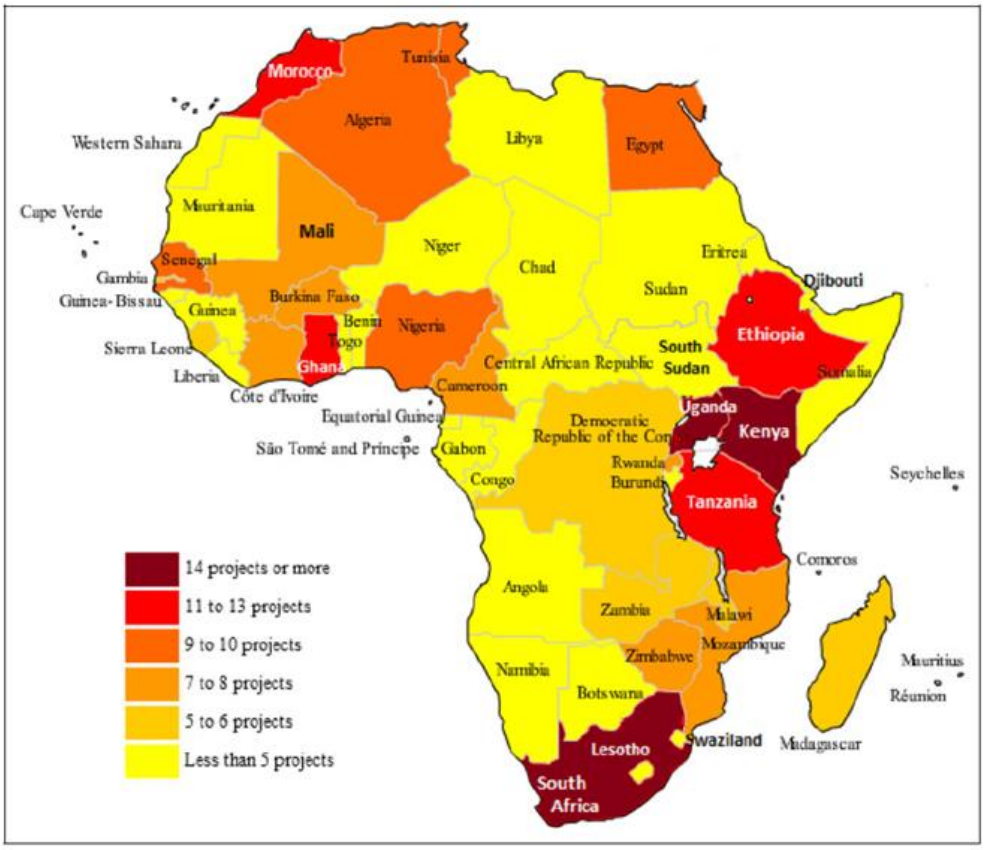


Figure 2.11: Rate of Telemedicine projects in Africa (Source: Jahangirian, M. and Taylor, S. J. E., 2015)

2.2.6. The current geopolitical situation of Libya

Libya experienced revolutionary movement against Gadhafi that ended his regime after 42 years in power (Bellamy, 2011). With this, the political dictatorship and transition in politics has weakened the political status that directly affects the research study. In the view of Gaub (2013), Libya is divided into two major rival governments that are backed with military campaigns. Libya is controlled under full territorial setback prevents the country from development and progress (Bellamy, 2011). A political stalemate as well as the spread of violence is frozen in this country which increases criminal activities such as kidnapping for ransoms and human trafficking coupled with illegal mass immigration from Africa through Libya to Europe.

Chesterman (2011) revealed some expansion of post-revolution in the recognition of a political situation is free from damages and potential status. It is understood that the Libyan crisis is seen as political and not as the result of military solution. At present, due to the crisis and unsafe conditions, Libya is not a safe place for conducting research studies and the majority of the researchers do not prefer to collect data from this region. Similarly, the Libyan crisis was reflected in the dealing with the current research study and the researcher chose different methods and techniques to collect the pilot and main field data in order to accomplish the aims and objectives set out at the beginning of the study.

2.3. Technology Adoption Theories

Zanaboni and Wootton (2012) referred to adoption as the utilisation of innovative technologies that affect the action of decision. The adoption of a certain technology is a result of a process of an individual or an organisation that should know about the technology, forming a favourable or unfavourable opinion about the technology's "persuasion" upon which they can decide whether to adopt the technology, or reject it (Zanaboni and Wootton, 2012). Healthcare providers and users are the ultimate users of Telemedicine technologies if it were adopted into the Libyan healthcare system. Therefore, it is required to underpin the theoretical models of technology adoption in general - specifically healthcare organisations.

2.3.1. Technology Acceptance Model

In 1986, Davis has developed the Technology Acceptance Model (TAM). Phichitchaisopa and Naenna (2013) stated that the idea of technology acceptance model was based on investigating the rational behaviour that involves knowing users' intention to adopt a technology. The Figure 2.12 demonstrates the components of the TAM model.

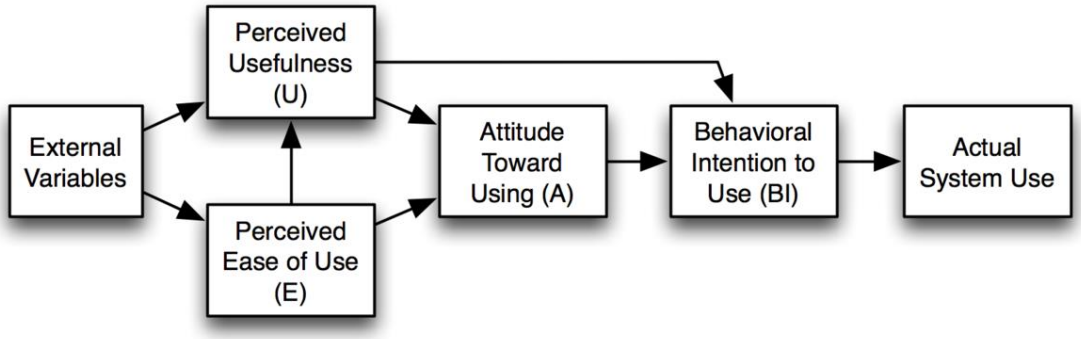


Figure 2.12: Technology Acceptance Model **(**Source: Davis, Bagozzi, and Warshaw, 1989)

TAM behavioural intention is determined by attitude and perceived usefulness that further influences attitude directly, while perceived ease of use directly affects both attitude and perceived usefulness.

The perception of the degree to which Telemedicine technology is easy to use would affect both perception of usefulness and attitude toward using the technology (Chau and Hu, 2002; Davis, Bagozzi, and Warshaw, 1989). It is indicated that there are two aspects that are important and impact the attitude towards considering the technology which as a result impacts use intentions and also the actual usage.

A number of scholars have made an attempt to investigate the concept and the validity of TAM. TAM studies revealed other initiating factors such as reasoning or thinking style and social influence. Ong et al. (2004) stated self-efficacy to be a perceived precursor of the usefulness and ease of use of the technology. In negation to this, Vijayasarathy (2004) mentioned self-efficacy, security as well as normative belief that have effect on the attitude.

Legris et al. (2003) concluded that TAM is a useful model, however it has to be integrated into a broader one which would include variables related to both human and social change processes, and to the adoption of the innovation model. Research in the field of innovation suggests that technological implementation is related to organisational dynamics, which will have a strong influence on the organisational operations and the outcomes (Legris et al., 2003).

Similarly, the employees working in the healthcare sector would have different nature of work and it is considered that they would be managed differently when it comes to the change implementation. Chau and Hu (2002) highlighted that understandably, the doctors are the principal operators and stakeholders of Telemedicine technological innovation. Compared with operators and managers in ordinary business settings, these doctors may show variations in the decision-making of technological innovation approval.

Chau and Hu (2002) investigated TAM and other models which mainly focused on healthcare professionals' decisions to accept Telemedicine technology. The overall findings of their research suggest that TAM whose explanatory power was of 42%, may be more appropriate than any other models. However, it was criticized for not explaining the remaining variance in behavioural intention (Abbasi et al., 2011). Furthermore, its limitations include barriers such as IT infrastructure or cultural context in developing countries' environments that stops users from utilising Telemedicine to its potential (Abbasi et al., 2011; Chen et al., 2002; Moon and Kim, 2001; Mathieson et al., 2001).

2.3.2. Theory of Reasoned Action

According to Sheppard et al. (1988), the Theory of Reasoned Actions (TRA) is found to identify the important factors which are linked to the intentional behaviour. This very theory defines the relationship between attitudes, norms, beliefs and behavioural intentions, which determines behaviour. Figure 2.13 shown below is the TRA model.

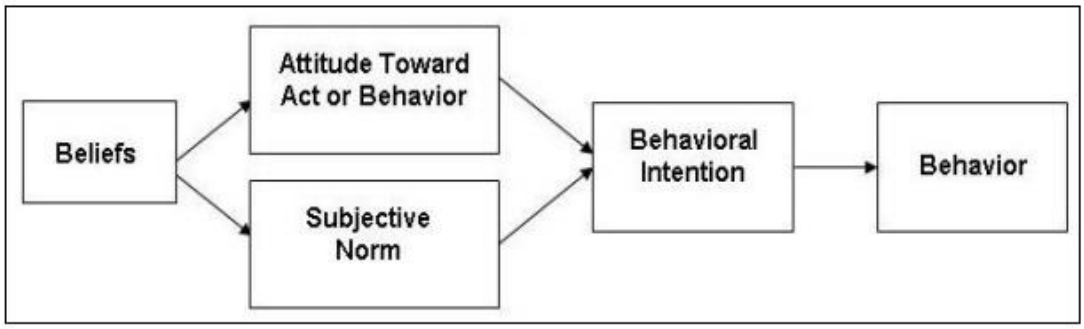


Figure 2.13: Theory of Reasoned Actions Model. (Source: Belleau et al, 2007)

The use of technology and its rejection is deemed to be an intention in making the behaviour which is being affected by individual attitude as well as by the subjective norms in relation to the behaviour. However, in contrast, it has been stated that intention helps in determining the effective behaviour which points towards the observable acts (Montano and Kasprzyk, 2008). In relation to the TRA, it has been mentioned that people tend to behave in a rational way, by evaluating what they have to what they lose as well as manifestation of the associated attitude. There are few aspects that affect the behaviour emitted at work and this includes values, goals, beliefs and attitudes (Montano and Kasprzyk, 2008).

Nevertheless, in the view of LaCaille (2013), TRA is considered to be the technology acceptance theory as it impacts the behaviour of the people towards technology implementation. The TRA model is a well-known model that has proven successful in predicting and explaining behaviour across a wide variety of domains (Cooke and French 2008). However, many have criticized the TRA model because it does not specify the beliefs that are operative for a particular behaviour such as Telemedicine usage (Succi and Walter, 1999).

2.3.3. Theory of Planned Behaviour

Apart from the aforementioned theory that explains the technology acceptance, another such theory is the Theory of Planned Behaviour (TPB). This theory seeks to complement the TRA and discusses the perceived behavioural control. According to Ajzen (2011), the TPB helps in foreseeing and explaining the behaviour of the people within a specific context such as in the information systems. Perceived behavioural control seeks to highlight accessibility to the resources and other opportunities for performing determined behaviour as shown in Figure 2.14.

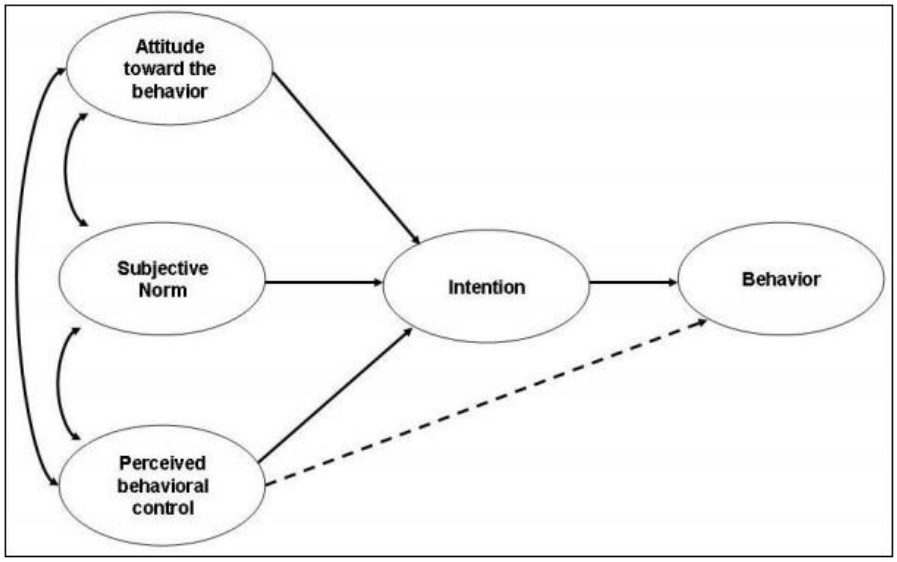


Figure 2.14: Theory of Planned Behaviour Model. (Source: McEachan et al, 2011)

This theory differs from the TRA just by the perceived behavioural control (Hagger and Chatzisarantis, 2009). In the view of Fielding et al. (2008), the behaviour is considered to be the succession of the affective and cognitive events that are preceded by the intention of acting upon something consciously.

TPB was investigated by Chau and Hu (2002) stating that doctors' objective to use Telemedicine technological innovation is identified by factors such as negative or positive evaluative impact of using the technological innovation as well as understanding others' views on whether or not to use technological innovation, and understanding of the accessibility to skills, sources and opportunities necessary for its use. However, assessed by informative power, TPB seems to be a slower concept than TAM.

2.3.4. Innovation Diffusion Theory

Innovation is considered to be the complex construct that can be explained from multiple perspectives (Henrich, 2001). In the view of Damanpour (1991), there are various types of innovation that are being considered, this is either technical versus administrative and product versus process innovation.

It has been mentioned that there are different factors that affect the "product/service" adoption, process innovation and the degree to which the innovation can impact the performance of the organisation (Hameed and Counsell, 2014). On the other hand, as stated by Vaccaro et al. (2012), organisations require the skills in order to develop and consider the product as well as process innovation. This all affects the way in which an organisation operates. Hameed and Counsell (2014) mentioned that innovation is one of the most important concepts that have been found to be linked to technology adoption. However, it has been highlighted that there are various factors which tend to influence the adoption. The four main aspects described include environmental, technological, individual and organisational factors which influence the adoption relating to innovation (Camisón-Zornoza et al., 2004).

Demands from trading partners, competitive pressures as well as consumers and the government have been examined under the environmental factors when it comes to technology adoption (Vaccaro et al., 2012). One of the studies by Camisón-Zornoza et al. (2004) indicated that there are three demographic factors that are being considered to affect technology adoption including size of the organisation, IT expertise as well as support from the management. Knowledge of the employees as well as business size and intensity of the information are some of the factors that seek to facilitate the

adoption of technology. On the contrary, Vaccaro et al. (2012) through their study examined the infusion and diffusion of the technology within organisations that further sheds light on the technology adoption within the organisations.

Diffusion of innovation is challenging in all domain areas including the healthcare sector where it can be accepted or rejected as it involves human operators and the day-to-day process or routine in real-life healthcare sitting are equally or more important than the software and the hardware of the promising technologies. Rogers (1995) advocated five attributes of innovation shown in Table 2.7 and these attributes could help clarify how individuals perceive attributes and predict adoption rate.

Table 2.7: Attributes of Innovation

Attribute	Description
Relative Advantage	It is the degree to which an innovation is perceived as better than the idea it supersedes.
Compatibility	It is the degree to which an innovation is perceived as being consistent with the existing values, past experience, and needs of potential adopters.
Complexity	It is the degree to which an innovation is perceived as difficult to understand and use.
Trialability	It is the degree to which an innovation may be experimented with on a limited basis.
Observability	It is the degree to which the results of an innovation are visible to others.

2.3.1.1. Innovation Adoption Curve

Jahangirian, M. and Taylor, S. J. E. (2015) stated that mobile phones usage are reaching over 90% of the Libyan population and amongst healthcare professionals which increases the interest in an innovative way of healthcare provision such as m-health, being part of Telemedicine applications, to access patient data and clinical diagnosis.
Rogers is the mind behind the creation of the innovation adoption curve. It seeks to classify the adopters of the innovation into various categories. This explains the openness and willingness of the individuals when it comes to the adoption of the innovation. Figure 2.15 shown below is the innovation adoption curve (Henrich, 2001).

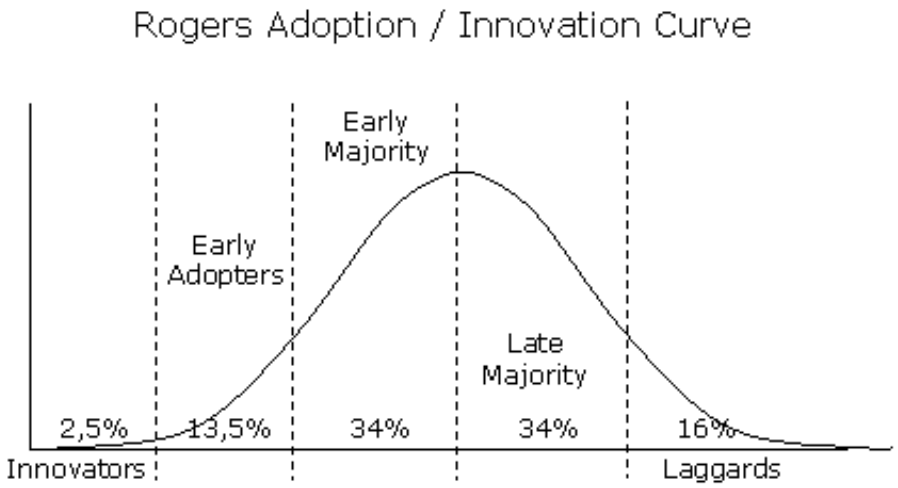


Figure 2.15: Innovation Adoption Curve by Rogers

The innovators, early adopters, early majority and late majority are described by Rogers (2010)as following:

Innovators: These are the "brave people" considering and pulling the change. They are considered to be one of the important entities in communication.
Early Adopters: They are the "respectable leaders" who give opinions as well as believe in working on the new ideas while dealing with the situations carefully.
Early Majority: They are considered to be the "thoughtful people". They are the ones that handle the tasks carefully but are also the ones that accept the change quickly.
Late Majority: They are the "sceptic people". They focus on contemplating the new ideas as well as "products" when the majority is already using it.
Laggards: They are the "traditional people". They focus on contemplating the old ways to critically review the new ideas and will only accept the new ideas as long as others have considered them as well.

Berwick (2003) made some recommendations for healthcare executives, who want to accelerate the rate of diffusion of innovations within their organisations, and these are: find sound innovations, find and support "innovators," invest in "early adopters," make early adopter activity observable, trust and enable reinvention, create slack for change, and lead by example.

2.3.1.2. Innovation Adoption Stages

From an organisational perspective, innovation refers to a stage-based process which is classified into various phases. Innovation adoption is the direct chain of activities from the phase of decision making to eventually putting innovation into practice for the organisational processes. The study of Rogers presents three stages that include initiation, decision and implementation (Prochaska et al., 2013). All these phases are usually referred to as pre-adoption, decision adoption and post-adoption in the literature.

According to Nakkas et al. (2015) the initial stage of pre-adoption finds out the need of innovating and creativity by collecting knowledge regarding the solution to improve the current innovation proposal for the adoption. In the second phase of decision adoption, evaluation of planned technology and decision making for the approval of innovation along with allocation of significant resources for facilitating an environment are highly considered. Lastly, the post-adoption phase covers innovation acquisition, users' acceptance and continuation of the usage of innovation for the operations of the organisation (Rafferty et al., 2012).

All these phases have their own significance and thus many researchers relate activities under pre-adoption, decision-adoption and post-adoption (Yang et al., 2015). Due to this reason, researchers use sub-stages: initiation which covers (pre-adoption), planning which covers (decision adoption) and execution which covers (post-adoption) in order to distinguish Information Technology adoption (Yang et al., 2015).

2.3.5. Social Cognitive Theory

Compeau and Higgins (1995) stated that Social Cognitive Theory was proposed by Bandura in 1986 and is a commonly approved and empirically verified concept of individual behaviour. According to this concept, viewing others' behaviour, in this case interacting with a computer, impacts the observers' views of their own ability to perform the behaviour, or self-efficacy, and the anticipated results that they understand, as well as offering techniques for effective performance. The core constructs of this theory are described in Table 2.8.

Table 2.8: Social Cognitive Theory Core Constructs (Source: Venkatesh et al., 2003)

Core Constructs	Description
Outcome Expectations Performance	The performance-related consequences of the behaviour. Specifically, performance expectations deal with job-related outcomes.
Outcome Expectations Personal	The personal consequences of the behaviour. Specifically, personal expectations deal with individual esteem and sense of accomplishment.
Self-efficacy	Judgment of one's ability to use a technology such as a computer to accomplish a particular job or task.
Affect	An individual prefers a particular behaviour such as computer use.
Anxiety	Evoking anxious or emotional reactions when it comes to performing behaviour such as using a computer.

From the literature reviewed in the above section, technology adoption theories have various processes or steps as well as factors to be considered if Telemedicine technology is to be adopted into the Libyan healthcare system. In this research, the factors which would be considered are to include healthcare service user Telemedicine acceptance, healthcare provider Telemedicine acceptance, Telemedicine outcome expectations and Telemedicine readiness at an organisational level. In the next section, the study focuses on is change and organisational readiness for innovation and the observed organisational capability factors which might impact Telemedicine adoption into the Libyan healthcare system.

2.4. Change and Organisational Readiness

Telemedicine implementation plans might ignore the part people play in healthcare system improvements by focusing on financial and technical sides associated with organisational change especially in developing countries (McNish, 2002; Howard, 2016). Researchers believe that Telemedicine projects and organisational change approaches should be considered to ensure successful implementation. Holt and Vardaman (2013) argued that readiness is involving both individual difference and structural factors, reflecting the extent to which the organisation and its members are inclined to accept, embrace and adopt a particular plan. Further, they assert that the implementation and diffusion literature has focused most heavily on the implementation phase of the process with less emphasis on the exploration phases such as readiness (also known as pre-implementation) or the sustainability phase (also known as post-implementation).

Queen (2017) said that for an organisation to use new technologies, it should go further than the technical implementation which should be a multidimensional process to transform the organisation to the required technological changes. He further indicated the rule of three pillars to successfully implementing changes and these tree pillars are people, process, and technology as shown in Figure 2.16 These three pillars should be working with and supporting each other which might provide a successful technological implementation achievement within the organisation in order to provide a service or a product.

Figure 2.16: The three pillars of People, process and technology (Source: Queen, 2017)

It has been observed that in today's world, the organisations are investing in the readiness process in which the integration of all the influencing factors is done to make the procedure successful and should help them in developing their productivity and efficiency.

2.4.1. Organisational Readiness

Fitzgerald and Russo (2005) reported that studies suggest failure largely due to organisational and social factors, rather than technical factors. In their own research, they found that almost all the issues were identified as problematic in the failure and these include, but are not limited to, understanding the needs of users of the system, including issues unrelated to the system itself, users' involvement in the development process, an improvement in the availability of resources, users' acceptance levels, and the preparation of infrastructure projects to develop confidence. All these issues will be under consideration during the development of this research framework work. Rafferty et al. (2012) advocated that the focus should be directed on readiness, which was defined as "*an individual's beliefs, attitudes, and intentions regarding the extent to which changes are needed and the organisation's capacity to successfully undertake those changes*".

Rafferty et al. (2012) examined, in a study of over 3,000 professionals, the affective element of attitude and a multilevel perspective in regards of change readiness. They reported that 2/3 of participants showed that their organisations were unsuccessful to accomplish a true change in efficiency after applying organisational changes, saying organisational change attempts are often so badly handled that they accelerated organisational crises. One limitation of their study was that capturing the dynamic nature of reactions while implementing changes. Furthermore, the study was looking into organisations and individual levels in developing countries. It would be necessary to assess and analyse the readiness of an organisation for change before initiating plans for e-Health projects in the Libyan Healthcare System.

Thurm (2011) introduced the S.W.I.T.C.H. diamond model and it is six areas or dimensions of readiness. This model is demonstrated in Figure 2.17. He explained that the readiness of service and product are connected to the core of the organisation's existence. The readiness of infrastructure includes material resources and data needed to provide a service or product. Behavioural readiness is related to the human – how they are treated by the organisation and within themselves as well as by any service user outside the organisation. Thurm (2011) stated that stakeholder and system readiness are somewhat the result of behavioural readiness and vice versa. Behavioural, stakeholder and system readiness are the supporting dimensions to the rest of other dimensions of readiness.

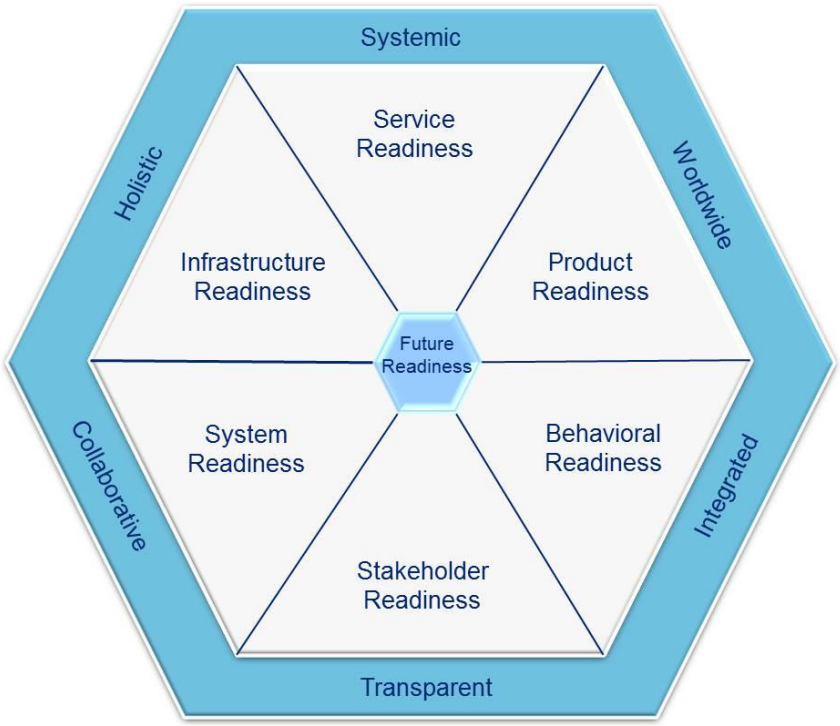


Figure 2.17: S.W.I.T.C.H. diamond model for readiness (Source: Thurm, 2011)

Brear (2006) said that there is a standard identification that various organisational capabilities and resources would affect the achievements of Telemedicine operation and this is supported by proof from multi-disciplinary and health-specific studies. He further stated that organisational capabilities and resources are connected and the actual phenomena and effect of each on the achievements of Telemedicine operation is not distinctive yet. A health-specific understanding and recognition of these capabilities and resources is necessary if Telemedicine applications are to reach their potential in healthcare settings (Brear, 2006).

2.4.2. Organisational Capabilities and Resources

Porter (1980) suggested that organisations should analyse their competitive environment, choose their strategies, and then acquire the resources needed to implement their strategies. However, by the view of Barney (1991), organisations might all be exposed to the same external environment such as opportunities, restrictions and threats, however they do not have the same access to capabilities and resources as these are internal attributes of an organisation. Organisational capability is defined by Winter (2000) as "*a high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type*".

There are several models related to organisational capabilities and resources such as those illustrated in Figure 2.18 which shows the links between SWOT (strengths, weaknesses, opportunities and threats) analysis, the Resource Based View Theory (RBV–Tangible & Intangible Resources) and other (internal & external) competitive advantage models.

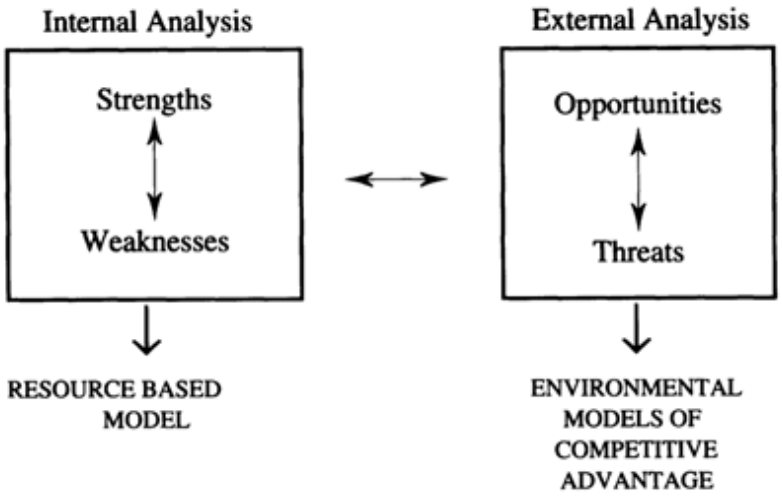


Figure 2.18: Links between SWOT analysis, resource based model and other competitive advantage models (Source: Barney, 1991)

Telemedicine and e-Health systems are thought, according to the challenges facing healthcare provision (Chapter 2, Section 2.2), to have threats and weaknesses that might hinder implementation of Telemedicine projects at an organisational level. Such as legislations, funding issues, lack of Telemedicine access for both healthcare providers and healthcare users, and even among those that have access, there might be reluctance to use Telemedicine solutions due to lack of ability to use such technology. Another potential threat is a lack of infrastructure suitable for e-Health systems as well as resources to sustain Telemedicine service provisions. Other possible weaknesses are difficulties using Telemedicine equipment, an increase of healthcare providers' workload and a disruption of their day to day routines.

Boddy et al (2009) developed a theoretical model (shown in Figure 2.19) to support the implementation of e-health systems. Through this model, they identified factors related to e-health projects and affected implementation, including strategy clarity; positive cultures and structures; impact on day to day operations; and how working employees observed changes. This model considered stakeholders' interests as a pre-implementation precursor before measuring the acceptance level and readiness for those interested in using e-health systems. Furthermore, IT infrastructure has not been taken into account as this model was not designed for developing countries and the IT systems were thought to be in place to facilitate e-health projects, which might not be the case in developing countries such as Libya.

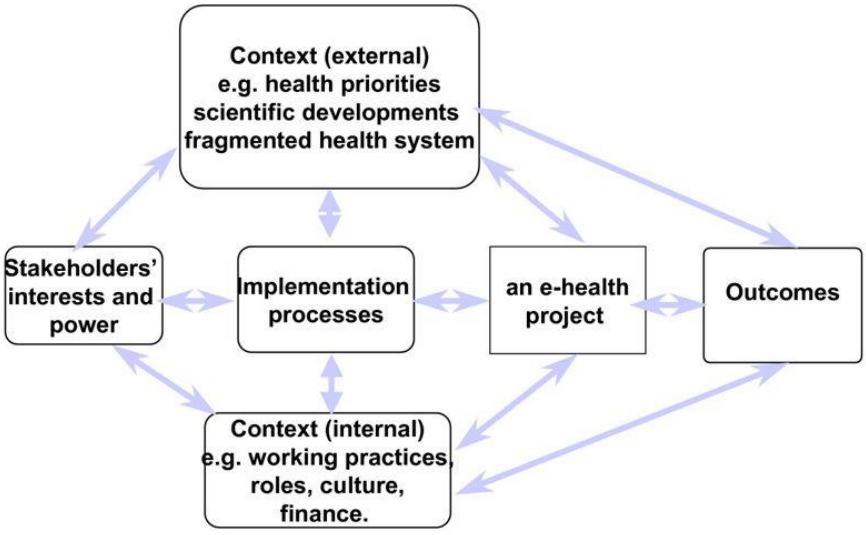


Figure 2.19: An interaction model of e-health implementation (Source: Boddy et al, 2009)

Some organisational resources and capabilities, which are thought to have led Libyan healthcare organisations to adopt Telemedicine technologies, are discussed as follows:

IT Infrastructure

According to Norris et al. (2015) it has been observed that majority of the changes that are brought within organisations are associated with the changes within IT infrastructure of the organisations. Development and implementation of new and advance technology has been playing its role in this respect. For this reason, organisations develop an IT infrastructure that helps them in developing their competencies further while adopting the advance technologies and developing their efficiencies (Roberts and Grover, 2012). There have been various methods and techniques suggested through models which would enable organisations to advance their IT infrastructure. According to Broadbent et al. (1999) there are certain elements of IT infrastructure as shown in the Figure 2.20 below.

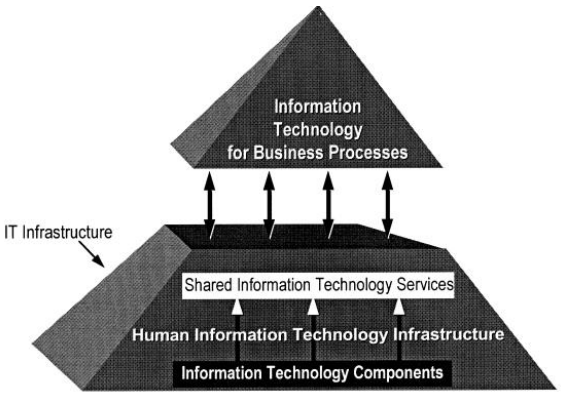


Figure 2.20: The Elements of IT infrastructure. (Source: Broadbent et al, 1999)

According to Van Ommeren et al. (2015) the factors and components mentioned in the first layer at the base of the pyramids are the IT components that would include computer equipment, communication technologies and other related supplies. The second layer contains shared IT services that may include management of large-scale data processing, provision of electronic data interchange capability, and management of database of the whole firm. It can be seen though the figure that the human resource of the company binds the IT components with the IT shared services.

This would require companies to have skilful and knowledgeable workforce. Then, this would all link with the business process which would comprise of the basic operations of the company that would be performed by the help and involvement of the components mentioned at the base of the pyramid.

Human Resources

Human resources that are the employees of organisations would also influence the change process within the organisations to a great extent (Jackson et al., 2014). It has been noted that when an organisation aims at bringing in any changes in their systems they tend to consider their human resources as a component of change (Adeniji et al., 2013). Furthermore, it has been observed that the organisations that take their human resources as part of their change and involve them in the process are relatively successful in change implementation (Molineux, 2013).

Organisational Learning

According to Bogabol et al. (2014), the learning capability of an organisation and individuals within this organisation might be considered as a key part when it comes to implementing the changes needed in the system. Organisations should adopt a learning process that would help in bringing the learning capabilities of organisations and employees in use (Moustaghfir and Schiuma, 2013). Jerez-Gómez et al. (2005) developed a learning process that linked the individual learning to organisational learning. However, this has been regarded as a complicated task in which the organisational learning is based on knowledge, which implies moving among the different levels of action, going from the individual to the group level, and then to the organisational level and back again (Moustaghfir and Schiuma, 2013).

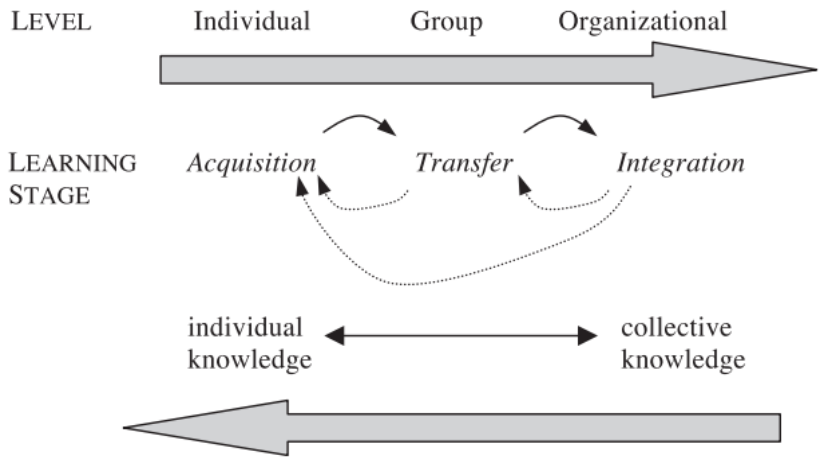


Figure 2.21: Organisational Learning Process (Source: Jerez-Gomez et al, 2005)

The process that has been showed in Figure 2.21 would start from knowledge acquisition of the individuals that would lead to further development and exchange, and integration of this knowledge to the point of a corpus of knowledge being created.

Operational Capabilities

It has been observed that operations of an organisation are greatly affected by any changes that might happen within the organisation. It was mentioned by Legris et al. (2003) that the use of technological innovation creates an efficient company and allows them to take advantage against their competitors. However, it has been learned that there is an important effect of technological innovation on the organisational operations. It would require organisations that are intending to implement a change within the organisation to develop a strategy for managing the operational activities of the organisation and overcome integration difficulties (Liu et al., 2013). There are various models introduced that are adopted by organisations when they are planning to develop operational change within the organisation (Birkinshaw et al., 2016). One of them is Lewin's Change Model which was developed by Kurt Lewin and is constructed of three phases: unfreezing, change and refreezing (Van den Heuvel et al., 2013). This model in Figure 2.22 helps organisations in understanding the change process.

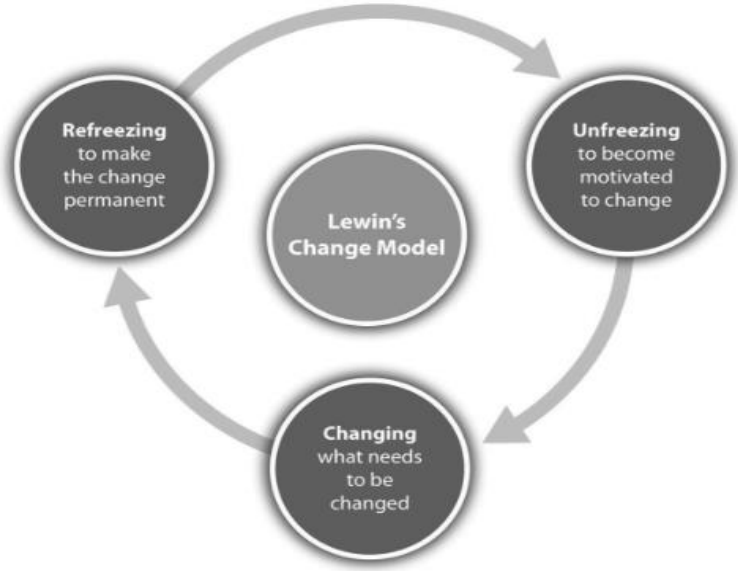


Figure 2.22: Lewin's Change Model

According to Van den Heuvel et al. (2013) the three phases that have been mentioned within the model can be explained as:

***Unfreezing*:** This is the point when the organisation prepares itself for the change and this requires developing ease and adaptation within organisations for adopting changes and developing an understanding for the change and need for change.

***Changing*:** This is called transition phase in which the organisation develops and implements the plan for change. There are various factors and measures that would contribute in the success for this change like training and development.

***Refreezing*:** This is the phase in which the change has been developed and accepted by the organisation and policies and standards have been developed for maintaining the changes.

Lehman et al. (2002) reported that Simpson, (2002) provided a model of program change that shows the significance of organisational features in adding to the change process. However, there is no complete tool for evaluating organisational readiness. Despite the comprehensive literature on change, the idea of 'readiness' is fairly new. Testing for readiness prior to the implementation of Telemedicine saves time, money, and energy by determining which communities are not able to successfully support immediate implementation (Jennett, Gagnon and Brandstadt, 2005).

Davis (2004) stated that patient safety is first and foremost a clinical problem, however it is also an important cause of wasted resources. Keeping patients safe can further be viewed as a public health problem and a human rights issue. Furthermore, Oun et al. (2017) stated that preventable harm to patients resulting from their healthcare is unacceptable at any time. Understanding whether, how much, why, and how patients are harmed through their healthcare systems is essential to inform the policy makers to adopt the most effective and efficient corrective strategies. Wilson et al. (2012) reported that there were no reports published from developing countries such as Libya on using e-Health applications to document clinical problems and prevent harm to patients. This knowledge gap is a serious limitation to understanding the extent of the problem at the national and global level.

2.5. Initial Conceptual Framework

Initial thoughts of a conceptual framework were developed, formatted and structured to include a number of assumed contributing factors identified from the extant literature which might influence the Libyan healthcare organisational readiness to adopt Telemedicine and e-Health system. Figure 2.23 illustrates the initial conceptual framework.

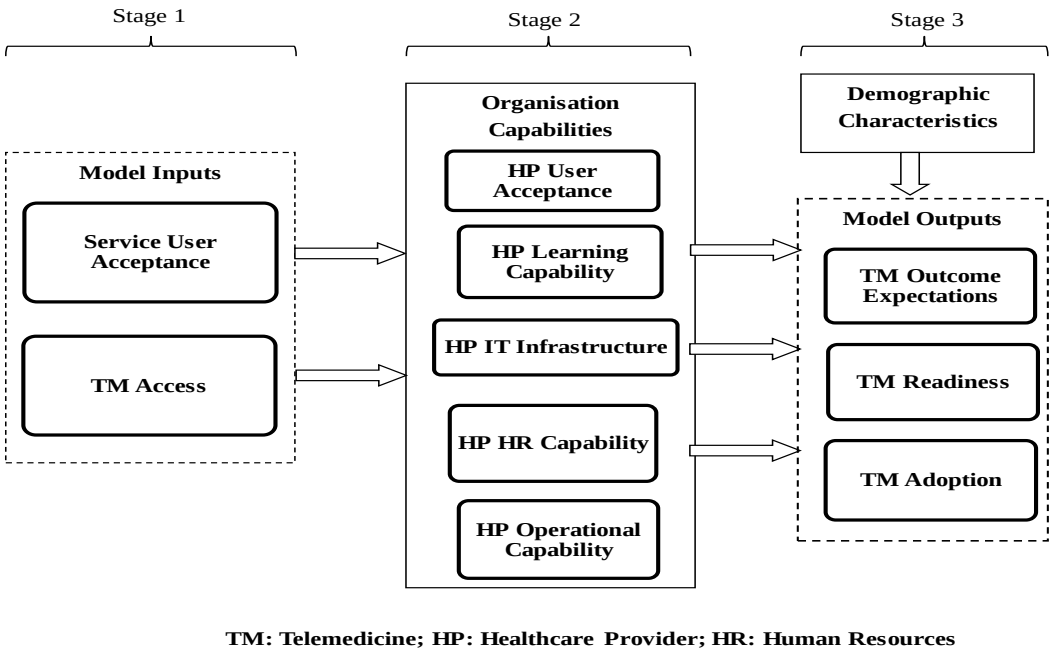


Figure 2.23: Initial Conceptual Framework

Komashie et al. (2007) stated that healthcare provision management and its control is not as innovative as in other industry areas. There are various reasons for this, such as variations between the areas in regards to concerns for value provision and the type of procedures and results involved (e.g. product compared to service). Furthermore, with the increasing interest in implementing industrial methods in healthcare sector, problems of suitability and functionality must be robustly investigated. An increasing concept from this is the need to create healthcare provision methods that give healthcare users a continuous "ownership" and pleasure for being part of the system. Implementing Telemedicine technological innovation and e-Health methods is one way of probability in this endeavour.

Daw et al. (2016) stated that the healthcare industry, internal and external environment should be all considered when investigating Telemedicine solutions and e-Health systems. In addition to this Nakkas et al. (2015) stated that to gain "advantages" of healthcare provision, healthcare organisations should consider employing their internal resources and capabilities, such as human resources, learning and information technology infrastructure capabilities which might facilitate Telemedicine access (user to provider and provider to provider), cooperation and cost reduction for both healthcare providers and users as an added value (value creation) to healthcare service provisions.

2.6. Chapter Summary

Innovative management strategies are required if the Libyan Healthcare System is to improve access to healthcare service provision. ICT is considered to have beneficial effects to improve healthcare services and Telemedicine can be one of the innovative management strategies in order to achieve the Libyan healthcare goals and objectives especially for monitoring chronic disease patients. Various researches over the recent years have studied the practicality and the ability of Telemedicine technologies to provide healthcare services such as the management of diabetes patients. However, in the case of the Libyan Healthcare System, the real disruption of healthcare provision and day to day operations' Telemedicine intervention in specific clinical setting and in general is still unidentified, poorly recorded and therefore, an empirical study is required to address this lack of studies in Libya.

The Technology Acceptance Model and Innovation Diffusion theories are found to be useful theories in healthcare survey situations, however they have to be integrated into a model which would include variables related to both human and social change processes as well as organisational dynamics, which will have a strong influence on the organisational operations and the healthcare outcomes. The S.W.I.T.C.H. diamond model for readiness is an emerging model to address the sustainability and pre-implementation, but does not consider user acceptance and use expectations.

The following chapter will concentrate on constructing a conceptual research framework, based on the literature reviewed. It will also show the construct measures for the model and the related hypothesis for this research.

Chapter Three: Conceptual Research Framework

This chapter integrates the findings from the literature review chapter into a conceptual research framework. The chapter further states the hypotheses of this research in order to test the research framework empirically. Figure 3.1 illustrates The Research Wheel which shows the importance of the research framework and its linkage between the research study or research theory with research field and data collection in order to add value or contribute to knowledge.

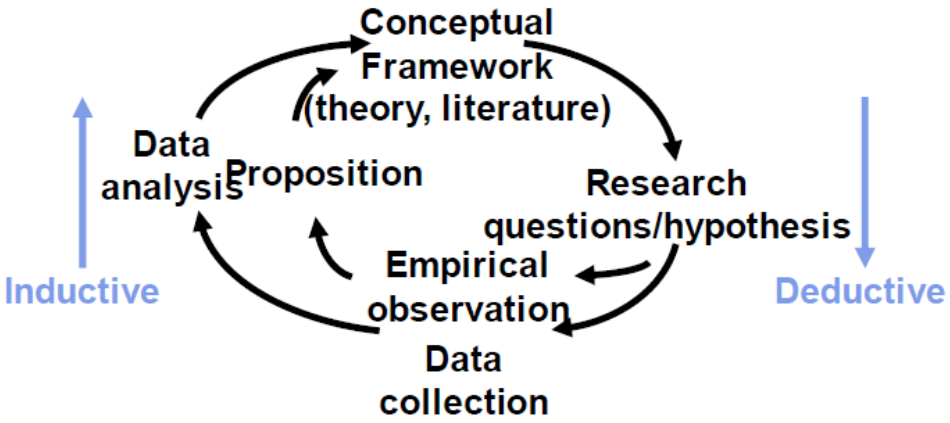


Figure 3.1: The Research Wheel (Source: Rudestam and Newton, 2007)

Swanson and Chermack (2013) defined the conceptual research framework as a display of the concepts and definition which are interdependent and co-related and originating from the existing theories in more structured form and are considered to be used in that specific research and are the foundation of the research problem. Conceptual diagrams, models and frameworks are frequently used to help describe the relationship between factors and outcomes (Earp and Ennett, 1991). It allows a researcher to investigate the relationship between research framework constructs derived from the existing literature in a logical manner (Anderson and Kitchener, 1998). In addition, it will direct the research to state the research hypotheses and help in selecting the research approach. Contradictory to this, Leamy *et al.* (2011) stated that it is not necessary that conceptual framework would make the overall task of preparing and applying standards easier than without a framework.

The conceptual research framework in the current study is a thought process, established and used as a lens to identify factors that have an impact on e-Health and Telemedicine Readiness in healthcare organisations in developing countries. Based on the literature review, these factors were included to emphasise their importance and their linkage to Telemedicine Adoption.

3.1. Conceptual Research Framework

Conducting the literature review in the fields of e-Health and Telemedicine, Healthcare Provision, Technology Adoption Theories, and Organisation Readiness for Innovation as well as identifying knowledge gaps and having feedback on the initial conceptual framework during the pilot study, the preliminary conceptual research framework is constructed and the factors are connected with links that are hypothesised to be of importance as shown in Figure 3.2.

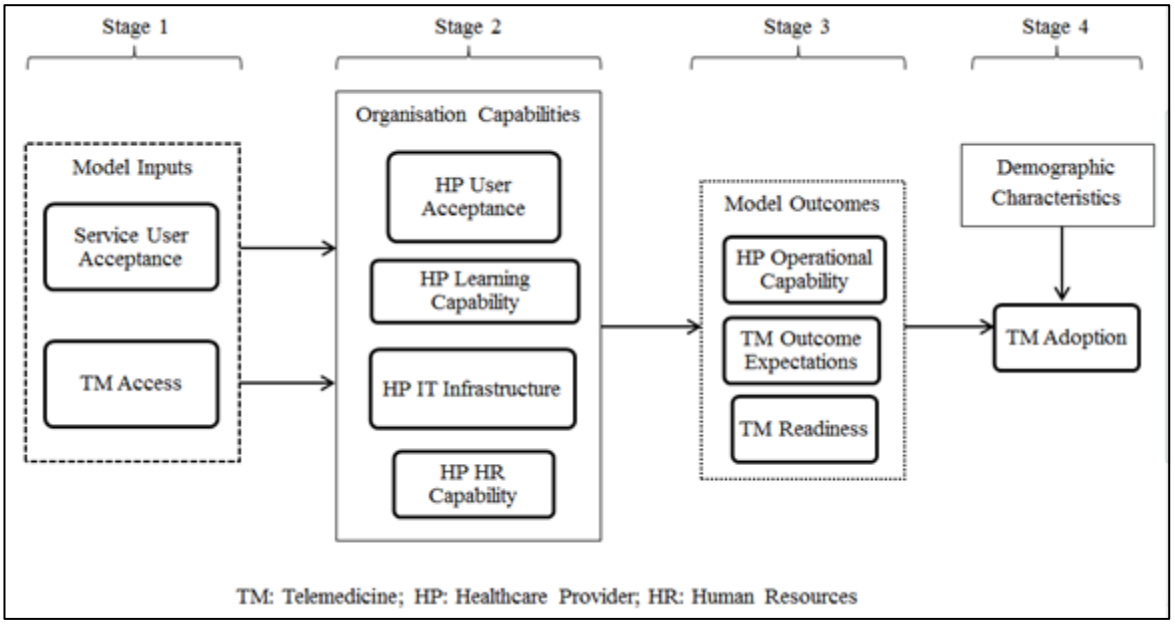


Figure 3.2: Preliminary Conceptual Framework.
(Keys: TM= Telemedicine; HP= Healthcare Provider; HR= Human Resources)

3.2. Construct (Variables) Measures

The constructs in the conceptual research framework are built and developed from the related literature. Factors regarded in the literature as major contributors in order to adopt Telemedicine technologies have been discussed below along helping the

developing countries' healthcare organisations in implementing the required changes for e-Health system projects.

3.2.1. Service User Acceptance

According to Davis (1986), a technology that is perceived as easy to use is more easily accepted by its users. Furthermore, in the study of Marshall (2013), it was stated that successful adoption of telehealth relates to the fact that the technology users should be in close collaboration with implementers and especially during the stages of development and piloting along with the evaluation. Solutions in telehealth, telecare, with further addition to telemedicine, are generally aided by solutions such as smartphones being provided by the user themselves which is the patient, the family and in other cases the friends of the patient. Overall, user acceptance is faced by the necessity for the integration of e-Health and Telemedicine technologies in daily activities and clinical practice workflow. Acceptance requires cultural and behavioural changes for use and reliance on Telemedicine technologies (Ackerman et al., 2010).

3.2.2. Telemedicine Access

Ackerman et al. (2010) advocated that major objectives of Telemedicine are to improve healthcare delivery to underserved inhabitants as well as healthcare coverage to all populations. Marcin et al. (2004) reported that inhabitants living in rural areas are challenged with major inequities in access to healthcare services compared with inhabitants living in urban areas. He further reported that Telemedicine has the potential to be a possible solution to address the clinicians' shortages and geographic barriers that rural inhabitants face and current e-Health and Telemedicine projects proved success for healthcare provision services for all. On the other hand, ease-of-access to technologies is obstructed by the lack of technology integration, interoperability, and standardisation (Ackerman et al., 2010). In addition to this, Ekeland et al. (2010) stated that the major disadvantage related to telemedicine is the availability and its cost. As for the provider it would be difficult and expensive to set up and maintain the telemedicine services and could also be very costly for the smaller healthcare facilities.

3.2.3. Stage 1 to Stage 2 Hypotheses

Further to what has been stated above, it is hypothesised that stage 1 factors are positively influencing stage 2 factors as shown in Figure 3.3:

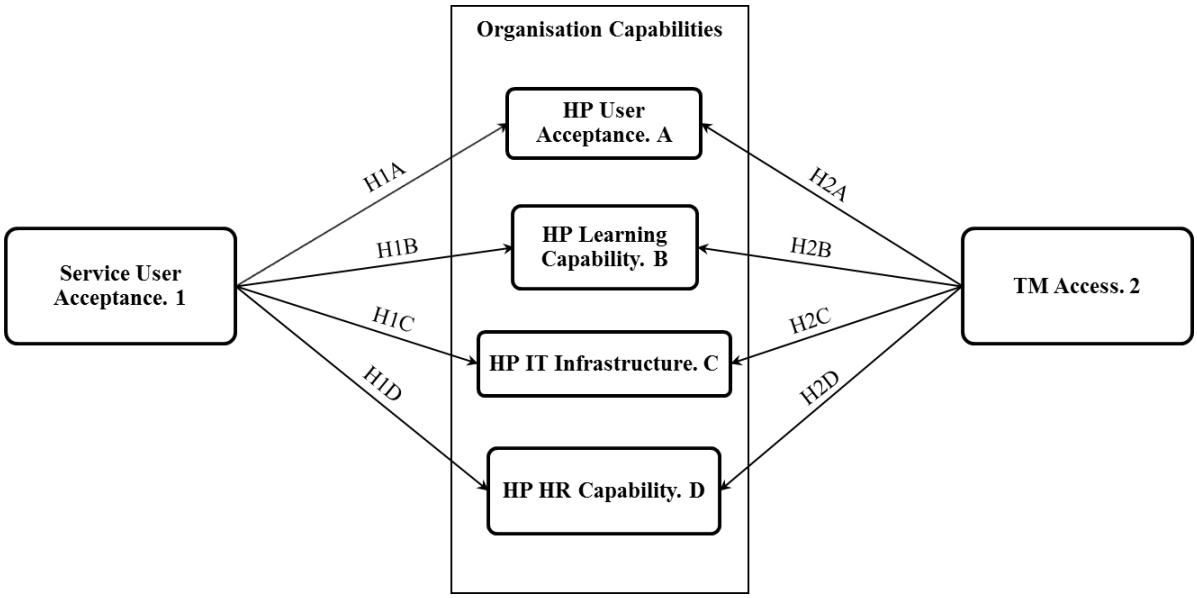


Figure 3.3: Hypotheses related to Service User Acceptance and Telemedicine Access (Keys: TM= Telemedicine; HP= Healthcare Provider; HR= Human Resources)

H1A. Service User Acceptance positively influences the HP User Acceptance.

H1B. Service User Acceptance positively influences the HP Learning Capability.

H1C. Service User Acceptance positively influences the HP IT Infrastructure.

H1D. Service User Acceptance positively influences the HP HR Capability.

H2A. Telemedicine Access positively influences the HP User Acceptance.

H2B. Telemedicine Access positively influences the HP Learning Capability.

H2C. Telemedicine Access positively influences the HP IT Infrastructure.

H2D. Telemedicine Access positively influences the HP HR Capability.

3.2.4. Healthcare Provider User Acceptance

Technology acceptance was defined by Agarwal and Prasad (1997) as current use of a system and intentions to continue to use it in the future. The acceptance of a technology innovation especially in healthcare is crucially helpful for healthcare professionals and patients, as well, in the course of diagnostics and treatments. In addition to this, Gagnon *et al.* (2012), stated that the behaviour associated with technology acceptance can be affected by different personal factors such as age, gender and socioeconomic status. Jennett et al. (2003) stated that if an organisation is prepared to accept technology, that means it is ready to adopt Telemedicine. Otherwise, the innovation is more likely to be rejected. Similarly, Melas et al. (2011) suggested that healthcare providers' attitudes towards the use of telemedicine are related to their intention to use such technology. In addition to that, attitudes towards the technology are influenced by healthcare providers' belief that using telemedicine will increase their job performance (perceived usefulness) as well as that telemedicine is free of effort (ease of use). There might be an increase in accepting the Telemedicine technology if the users are well aware of its benefits and have the knowledge of how easy utilizing this technology could be.

3.2.5. Healthcare Provider IT Infrastructure

In regards to the development of IT infrastructure, organisations should focus on developing an infrastructure to improve a system that would support the long-term goals of the organisations and should be able to respond to the business demands that keep changing with time (Dehling and Sunyaev, 2014). Development of an IT infrastructure is a complicated task that requires the organisation to consider all its competencies which can be made part of this IT infrastructure (Roberts and Grover, 2012). Integrating information technology within an organisation will facilitate the coordination and monitoring of the organisation's resources (Jean, Sinkovics, and Kim, 2008). In the view of Ahlan and Ahmad (2014), health information technology is defined as an area which comprises of information systems, computer science and healthcare. This specific area is gaining attention due to advancement in technology and issues related to healthcare delivery. The systems that are used and developed in this specific field are called Health Informatics or Health Information system. Healthcare professionals take decisions regarding their patients and sometimes it takes extra time and even resources.

Therefore, incorporating decision-making components into Health information technology is important. This decision-making capability will be helpful for the doctors and other related medical experts in managing their patients with more ease.

3.2.6. Healthcare Provider Human Resources Capability

This factor has been brought into consideration by the researchers, as well, in which they have been developing various models and theories that would help the organisations in this regard (Jackson et al., 2014). The implementation and adoption of any model would rely on the nature of the workforce and the organisation, too (Adeniji et al., 2013). These models including TAM, TPB, TRA and IDT (details discussed in section 3 in chapter 2) are associated with the management of human resource highlighting the factors that would influence the behaviour of employees. Similarly, the employees working in the healthcare sector would have different nature of work and they would be handled differently when it comes to the change implementation. According to Blaya, Fraser and Holt (2010), in order to make sure that Telemedicine technologies are used efficiently by the workforce, focus should be given on the training. It is vital that human resource personnel should consider the configuration of the health workforce related to skill categories and training levels both. The training process would be helpful in making sure there is no resistance from the employees for the new technology. It is also necessary that the human resource department in the health sector should be well equipped and well qualified for the modern technology.

3.2.7. Healthcare Provider Learning Capability

According to Jerez-Gómez et al. (2005), the learning of an individual within an organisation greatly depends upon what is already known by the other members of the organisation, that would be the knowledge base of the organisation. They explained that the learning process contains three aspects. The first would include the knowledge and its creation with its integration within the organisation. This develops the idea that organisational learning includes more than the individual learning of employees. The second would include creation and dissemination of knowledge and developing a constant internal change that would happen at the behavioural or cognitive level. The third would include constant improvement within system that would lead to improvement within overall process of the organisation. This may help the organisations

in achieving competitive advantage in which the organisations' different learning capabilities would be used (Moustaghfir and Schiuma, 2013).

In addition to this, Fang, Chang and Chen (2011), stated that due to continuous changing business environment it is crucial for the managers within the organisation to seek and identify new ways for organisational capability in order to predict the need for change and the competence of the incessant adaptation. The learning process of an organisation is helpful in promoting continual adaptation and enhancement of the healthcare provision. Therefore, it is necessary that the healthcare managers within the organisation should promote learning environment within the workforce. In the view of Gunsel, Siachou and Acar (2011), the organisational learning capability is considered as the source of competitive advantage and the vital factor for the success of the organisation in the future. There are various dimensions that are related to organisational learning capability.

Jerez-Gómez et al. (2005) highlighted certain dimensions for organisational learning capability that included managerial commitment, systems perspective, openness and experimentation, knowledge transfer and integration. Goh and Richards, (1997) further highlighted a similar factor in which they developed a relation between individual learning and organisational learning, in addition to other similar factors or dimensions for organisational learning.

Clinicians might have higher-than-average learning capability or intellectual capacity that may enable them to master Telemedicine technologies with less extensive training than what is necessary for other user groups. Furthermore, they might have access to staff support from nurses and technologists in e-Health service operations and Telemedicine equipment. These points are likely to result in acceptance of e-Health system and Telemedicine technology (Chau and Hu, 2002).

3.2.8. Stage 2 to Stage 3 Hypotheses

Further to what has been mentioned above, it is hypothesised that stage 2 factors are positively influencing stage 3 factors as shown in Figures 3.4, 3.5 and 3.6:

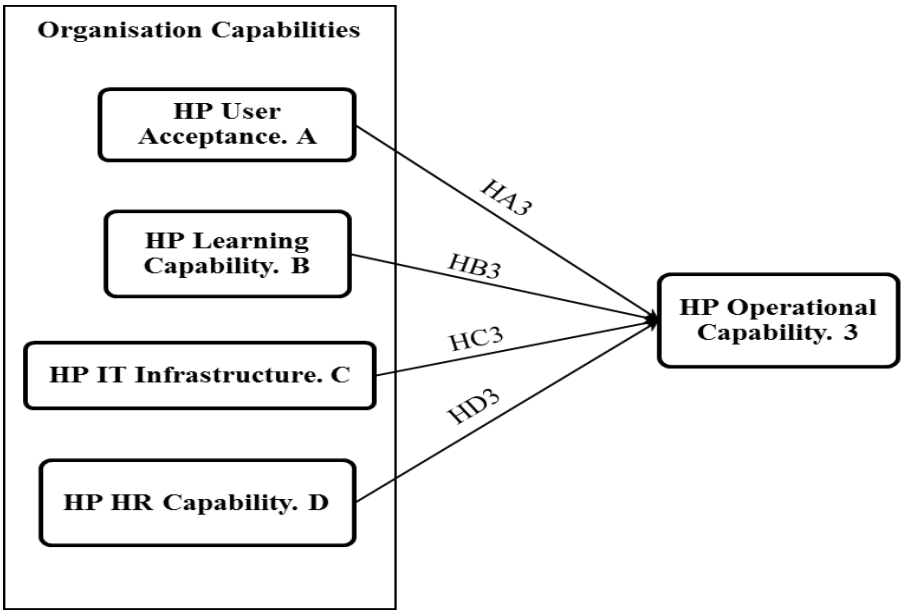


Figure 3.4: Hypotheses related to HP Operational Capability
(Keys: TM= Telemedicine; HP= Healthcare Provider; HR= Human Resources)

HA3. HP User Acceptance positively influences HP Operational Capability.

HB3. HP Learning Capability positively influences HP Operational Capability.

HC3. HP IT Infrastructure positively influences HP Operational Capability.

HD3. HP HR Capability positively influences HP Operational Capability.

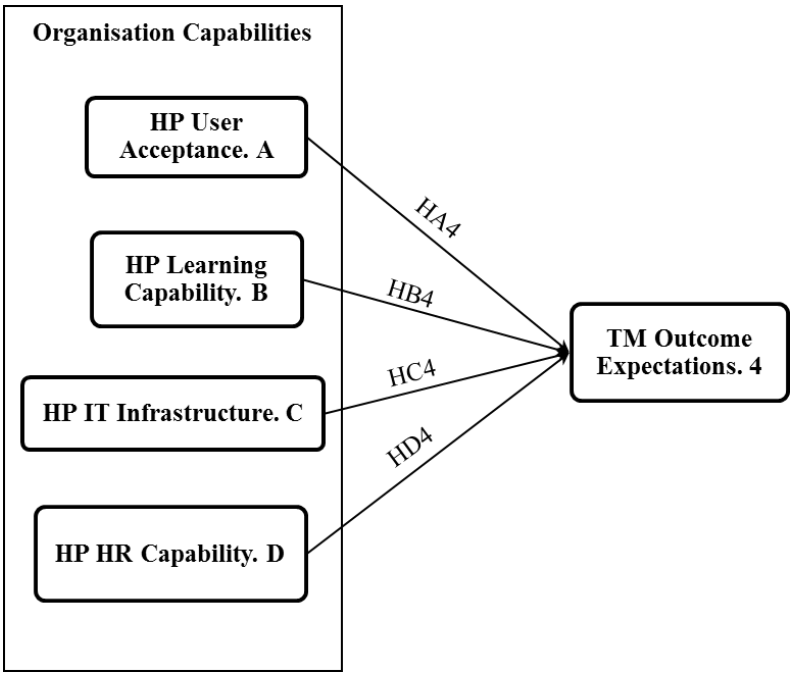


Figure 3.5: Hypotheses related to Telemedicine Outcome Expectations
(Keys: TM= Telemedicine; HP= Healthcare Provider; HR= Human Resources)

HA4. HP User Acceptance positively influences Telemedicine Outcome Expectations.

HB4. HP Learning Capability positively influences Telemedicine Outcome Expectations.

HC4. HP IT Infrastructure positively influences Telemedicine Outcome Expectations.

HD4. HP HR Capability positively influences Telemedicine Outcome Expectations.

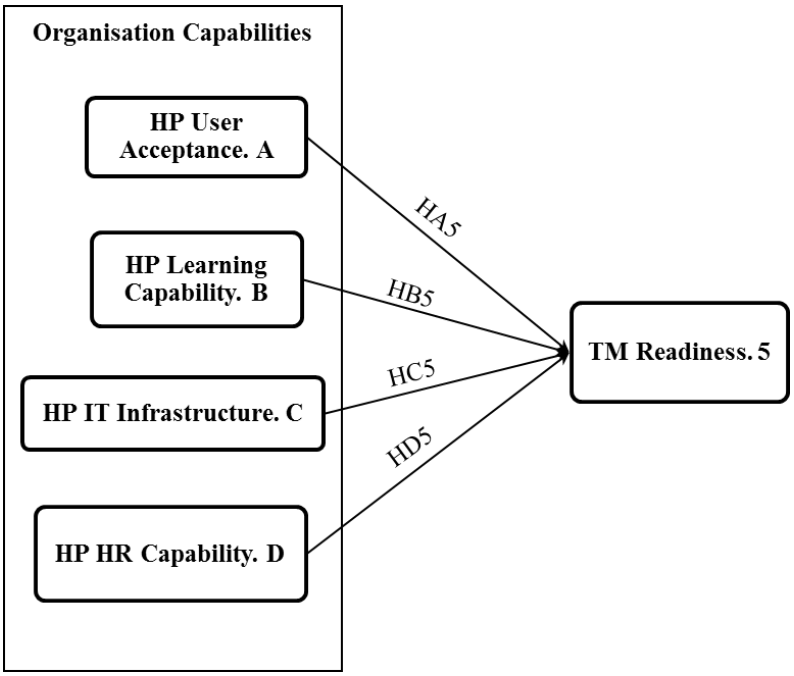


Figure 3.6: Hypotheses related to Telemedicine Readiness
(Keys: TM= Telemedicine; HP= Healthcare Provider; HR= Human Resources)

HA5. HP User Acceptance positively influences Telemedicine Readiness.

HB5. HP Learning Capability positively influences Telemedicine Readiness.

HC5. HP IT Infrastructure positively influences Telemedicine Readiness.

HD5. HP HR Capability positively influences Telemedicine Readiness.

3.2.9. Stage 3 to Stage 4 Hypotheses

Brear (2006) summarised that organisational resources and capabilities are recognised by the majority of scholars to be influencing the use of Telemedicine in healthcare provisions. This is evident by many multi-disciplinary and health-specific researches. Organisational factors are extremely interconnected and the precise of their dynamic and impact of each for a successful Telemedicine intervention is yet to be clear. A health-specific acknowledgment and understanding of these factors is essential if the potential of Telemedicine technologies were utilised to provide healthcare services.

Furthermore, the day to day routines in healthcare setting should be taken into account to address issues such as technology interaction, skill workability, adequate technology and stakeholders' (such as healthcare front-line staff and patients) involvement, who might have financial concerns as well as concerns for safety, privacy and liability of using the technology, time spent to provide services, the efficiency of such healthcare provision option and patient-provider's relations.

It is hypothesised that stage 3 factors are positively influencing Telemedicine Adoption as shown in Figures 3.7:

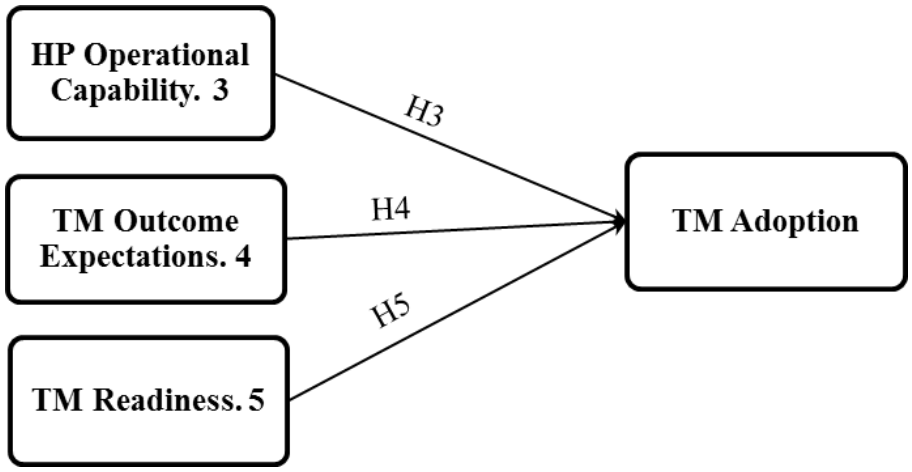


Figure 3.7: Hypotheses related to Telemedicine Adoption
(Keys: TM= Telemedicine; HP= Healthcare Provider)

H3. HP Operational Capability positively influences Telemedicine Adoption.

H4. Telemedicine Outcome Expectations positively influence Telemedicine Adoption.

H5. Telemedicine Readiness positively influences Telemedicine Adoption.

3.3. Constructed Measures

The constructs in this study were developed from related literatures and Table 3.1 is demonstrating the construct measures source.

Table 3.1: Information sources for constructed measures

Construct	Source
Service User Acceptance	Green et.al, 2006; Doyle, 2006; Yu 2009; Vega, 2011; Davis, 1989; Ackerman et al., 2010; Marshall, 2013
Telemedicine Access	Dionisia, 2006; Murry, 2011; Vassal, 2001; Jane Zapka, 2012; Krause, 2013; Ackerman et al., 2010; Marcin et al., 2004.
Healthcare Provider User Acceptance	Ludwick, 2009; Doyle, 2006; Yu, 2009; Agarwal and Prasad, 1997; Davis, 1989; Jennett et al., 2003; Melas et al., 2011
Healthcare Provider Learning Capability	Ludwick, 2009; Brear, 2006; Goh and Richards, 1997; Jerez-Gómez et al., 2005; Moustaghfir and Schiuma, 2013
Healthcare Provider IT Infrastructure	Damigon, 2006; Lee, 2007; Yoo, 2013; Ludwick, 2009; Broadbent, 1999; Dehling and Sunyaev, 2014; Jean et al., 2008; Roberts and Grover, 2012.
Healthcare Provider Human Resource Capability	Mouzakitis, 2008; Adeniji et al., 2013; Jackson et al., 2014

3.4. Chapter Summary

In this chapter, the conceptual research framework was formulated where framework factors were extracted from the extant literature review which indicates that Healthcare organisations should meet the needs of the populations for better access to healthcare services as an added value for the users. E-Health systems and Telemedicine technologies may be the answer for better healthcare provisions, however there might be organisational capabilities and resources issues such as technologies acceptance, IT infrastructure and human resources and these should be studied as they might impact the readiness to adopt such technologies. The next chapter will examine different approaches used for carrying out research in order to identify the appropriate approach for this study. Furthermore, the chapter will cover data collection approach, questionnaire design, pilot and main field study.

Chapter Four: Research Methodology

The current chapter will review some fundamental strategies of research approaches that will help to identify the appropriate statistical methods for this study. Ethical considerations, sample size and study designs will also be discussed in this chapter. It will further offer an evaluation of the approaches employed for both data collection and data analysis and the rationale behind using them. The research studies innovation as well as organisation resources and capabilities, and recognises healthcare sector diversity. So, it is thought reviewing research approaches towards those different arenas in order to learn and then choose what method and methodology work best for this study.

4.1. Research Paradigms

4.1.1 Positivism versus Interpretivism

There are two key philosophical research paradigms: positivism and interpretivism (Sproull, 2002). Positivism focuses on identifying the important relations or patterns of the phenomenon being studied. It is linked with confirmatory research that attempts to approve pre-specified relationships between factors (Hair et al., 2010) and is associated with quantitative methods that are structured, such as questionnaires and experiments.

In contrast, interpretivism discusses that statistical patterns and correlations cannot be fully understood alone, thus, there is a necessity to found the values and meanings given by individuals to such activities that eventually results in observed patterns. This second approach is linked with exploratory research which attempts to identify the phenomenon of relationships between factors (Hair et al., 2010) and is associated with qualitative methods which are recognised as unstructured, such as participant observation studies and in-depth interviews (Creswell, 2013). The following table 4.1 reviews the major differences between Positivism and Interpretivism research approaches.

Table 4.1: Positivism vs Interpretivism (Collis and Hussey, 2013; Creswell, 2013)

Positivism	Interpretivism
Reality is objective and separate	Reality is subjective and inseparable
Knowledge based on observable facts outside of the human mind	Knowledge determined by people rather than by objective external factors
Uses large samples	Uses small samples
Theory testing	Theory generation
Statistical analysis	Observation of individuals' interpretations of the phenomenon
Deductive approach	Inductive approach

Positivism is associated with the deductive theory of verification by hypothesis testing to confirm relationships as suggested in literature (Bryman, 2003). On the contrary, interpretivism is associated with the observation of social phenomena by individual interpretation and with the quantification nature (Kavoura and Bitsani, 2014). Therefore, researchers detect phenomena and study its characteristics to find any existing relationships by observation and interpretation of its development (Creswell, 2013). The literature reviews within technology adoption suggest that positivism and survey-based method was predominantly used when considering the topics of user acceptance and usage of the technology compared to interpretivism and interview-based method which was mostly used when investigating acceptance concerns at organisational level (Choudrie and Dwivedi, 2005; Wiles et al., 2013). Bowling (2002), similarly, explained that in the healthcare sector, research methods and methodologies on health and healthcare service provision ranges from interpretivism and descriptive examinations of the people's experience of ill health to assessments of healthcare services in terms of costs and effectiveness (health outcomes). It is vital to take account of people's perspective in healthcare service provision when conducting a research (Bowling, 2002) which was recognised during this study.

In this research, positivism paradigm was practiced as Telemedicine Readiness and Adoption into the Libyan healthcare system at organisational level were measured. Therefore, a conceptual framework was developed and a questionnaire was used to collect data from a population of 620 Libyans healthcare professionals, mainly clinicians, in which 161 have participated. The data was analysed using SPSS statistical software. However, innovation and technology adoption techniques used in this study

are overlapping with the diverse healthcare services and so participants' comments are allowed in order for other factors to be raised and captured.

4.1.2 Quantitative, Qualitative and Mixed Methods

Selecting a research method to conduct a study is a critical stage of any research. Telemedicine Readiness and Adoption into the Libyan healthcare system at organisational level are going to be examined, a quantitative method will be adopted as the main approach for the pilot study to refine the questionnaire as a research instrument and then to be used in the main field study. In addition, open questions were recognised and valued. Furthermore, validation interviews will be conducted to allow for further comments on the study results. The use of both methods together results in a more robust research than the use of only a qualitative or quantitative method. Due to the fact that each (qualitative or quantitative) methodology technique has benefits and disadvantages, using both techniques in the form of a mixed-method approach might be worthwhile for strengthening research validity (Creswell, 2013; Jick, 1979).

Quantitative research is defined by Creswell (2013) as a method of testing objectives that have been designed in order to study the relation between the different variables which are further put to evaluation on several different instruments which allows for the numeric data to be obtained and analysed via various statistical measures. It researches exam theories deductively through current knowledge by producing and developing hypothetical relationships and suggested outcomes, all of which assist in finding scientific results.

However, qualitative research is defined as a method which studies the meaning groups or individuals have in relation to an existing human or social issue. During the research course, questions and techniques start surfacing and developing. Normally, data collection would be at participating individual's setting. Data analysis is built from details to broad themes and the researcher interprets the meaning of the collected data. (Creswell, 2013).

These methods were discussed and reviewed in a workshop at the British Academy of Management Doctoral Symposium (BAM 2012) at Cardiff University. The following Table 4.2 offers insight into the key differences between quantitative and qualitative methods.

Table 4.2: Quantitative vs Qualitative Methods (Bryman, 2003; Creswell, 2013)

Quantitative Method	**Qualitative Method**
Deductive approach, testing of theory	Inductive approach, generation of theory
Associated more with scientific research	Not viewed as scientific
Confirm or reject hypotheses about phenomena	Explore new phenomena
Use highly structured methods such questionnaires, experiments, and structured observation	Use semi-structured methods such as in-depth interviews, focus groups, and participant observation
Larger sample size and uses statistical analysis	Smaller sample size
Closed questions format	Open-ended questions format
Numerical data format (obtained by assigning numerical values to responses)	Textual data format (obtained from audiotapes, videotapes, and field notes)
Participant responses do not influence or determine how and which questions researchers ask next	Participant responses affect how and which questions researchers ask next
Study design is subject to statistical assumptions and conditions	Data collection and research questions are adjusted according to what is learned

According to Condelli and Wrigley (2004), a better understanding is obtained and can be ensured by the combination of both qualitative and quantitative methods of research. Creswell (2013) suggested that if mixed methods were applied, the study results would be relatively more precise, desirably from various standing frameworks. This has been supported by Cornford and Smithson (1996), who suggested that the planning of quantitative and qualitative methods to be mixed should be observed as a balancing tool for a research method, with each including measuring instruments that might be considered relevant to particular conditions. Joining both qualitative and quantitative methods brings two significant benefits. The first one is increasing the confidence related to the findings and the research validity, and the second one is potentially increasing the uniqueness of the study.

Furthermore, Creswell (2013) stated that a combination of quantitative and qualitative methods might allow for various data to be gathered on the same question, using the benefits of each method in order to overcome the disadvantages of the other, attaining a greater degree of validity and reliability, and overcoming the weaknesses associated with a single-methodology study. In addition, the researcher was at the Telecare Services Association (TSA) conference in 2012 in which The Whole System Demonstrator programme presented their research and they combined both quantitative and qualitative approaches as their research methodology (Department of Health, 2011).

4.2. Current Research Methodology

The aim of this research is to understand Libyan healthcare organisations' readiness for the adoption of Telemedicine using technology acceptance techniques. In order to grasp this understanding, current and recent healthcare personnel were surveyed to examine the conceptual framework and its factors.

Telemedicine solutions and e-Health systems are observed to be founded on information systems (IS) with the host of healthcare discipline. Information systems are a combination of two primary fields: computer science and management (Walsham, 1993). Chen and Hirschheim (2004) examined 1893 information systems articles published between 1991 and 2001 and their findings were that the positivist research still dominates and tends to be more quantitative, survey oriented with cross-sectional technique. However, they further reported that there is a rise in qualitative research and longitudinal studies which might suggest that IS researchers have become more concerned in obtaining scientific knowledge in real domain settings.

Mingers (2001) argued that for the implementation of a mixed method approach within IS research and in designing such methodologies for any research study, attention should be set to measurements of a real situation, material, social, and personal (including the capabilities and characteristics of the researchers). This should lead to the construction of a multi-method, multi-paradigm research design.

Mackert et al. (2014) in their review of e-Health research methodologies reported that nearly all researches adopt surveys-based data collection method and the most common approach offered quantitative outcomes (Harris et al., 2018).

Since Telemedicine is an innovative healthcare provision and the healthcare personnel such as clinicians and nurses are meant to accept and sustain this new technology for service delivery, thus their perspectives are important. Additionally, and based on the aims and objectives of this research to investigate healthcare providers' perspective and from the research literature on technology adoption and organisation readiness which resulted in constructing a conceptual research framework to predict Telemedicine Readiness and e-Health Adoption, the current study will employ mixed method approach with the orientation of quantitative and questionnaire based survey in order to achieve the best possible research design and accurate results with consideration of the research question, the research aims and objectives.

Assistance of scientific measures and statistical analysis are required to test hypotheses related to the conceptual research framework to discover the relevant data and this would not be achieved by adopting qualitative methods only (Collis and Hussey, 2003). Nevertheless, qualitative methods would obtain information in real world healthcare settings by capturing real situation, material, social, and personal dimensions through healthcare providers' perspective (Creswell, 2013; Mingers, 2001). Furthermore, the chosen research approach is largely used in the healthcare arena (Andrew and Halcomb, 2009; Casebeer and Verhoef, 1997).

The study first used a qualitative method in the pilot study (See Section 4.6 and Table 4.3 for more details) by targeting 15 Libyans, mainly clinicians, who were attending and participating in a 3 days conference in June 2014 organised by the Libyan Embassy in London, in order to test the face and content validity of a questionnaire as a measurement tool (Appendix A) as well as asking their opinions of the constructed conceptual framework and further talking in open conversions regarding the Libyan healthcare provision and the challenges facing both healthcare providers and healthcare users (patients and carers).

The framework was then developed according to the feedback obtained and the main field questionnaire was sent to a population of 620 Libyans, mainly clinicians, who were attending short-term training courses or studying for further education in the UK and who have been healthcare providers in Libya. The questionnaire was collected by emails and followed with email reminders. Further data was collected face-to-face with the participants almost on a daily basis when they were on routine visits to the Cultural Affairs' offices at the Libyan Embassy, for different reasons.

The emails' contact details were obtained by permission from the Libyan embassy in London (Appendix B) and after being granted access to their database. The face-to-face data collections were voluntarily agreed upon and permission was obtained through the participants' verbal consent.

The main field data of 161 respondents was collected between the end of July and the end of September 2014 (See Chapter 5, section 5.2.1 for more details). The collected data were analysed using SPSS statistic IBM software, version 20, to determine the internal consistency by calculating Cronbach's alpha for each construct in the questionnaire as well as other tests such as factor analysis and regression analysis to increase the confidence of the findings, interpretation and the validity of the measurement tool used in this research.

The researcher also conducted on-line interviews using communication technologies such as skype in order to validate the model developed with Libyan healthcare experts. The interview questions covered factors included in the proposed model. Three participants from different healthcare providers took part in the interview in February 2019. An ethical approval was obtained from Brunel Ethical Committee in January 2019 to conduct these interviews. An information sheet, a covering letter and a consent form were sent to all participants before the interviews to guarantee the privacy of their information and to introduce the study to them for better understanding (see Appendix B).

4.3. Research Process

Research success depends upon the selection of the correct research process within research design (Hussey and Hussey 1997). Figure 4.1 illustrates the steps of the current research process as follows.

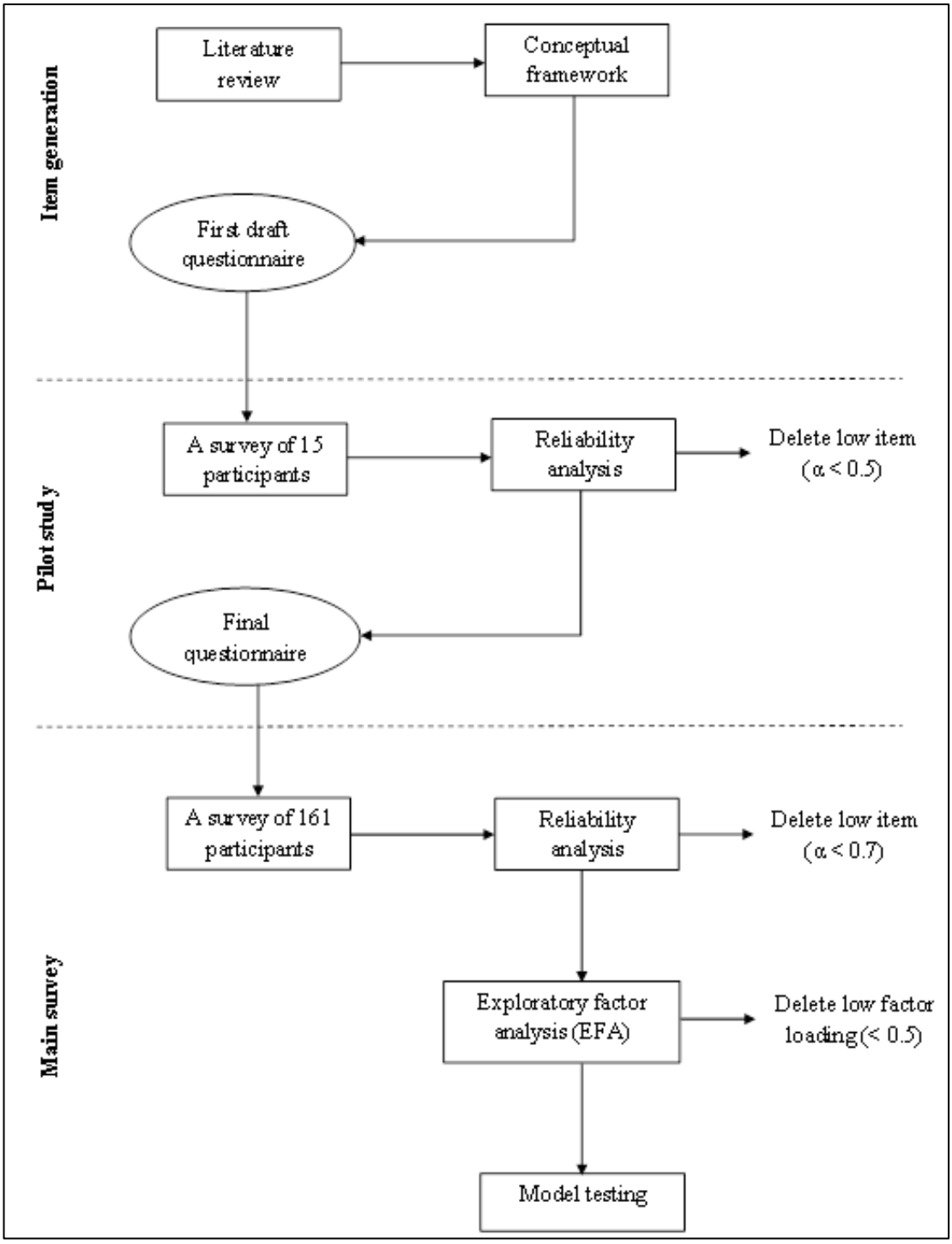


Figure 4.1: Research Design Process

4.4. Questionnaire Design

The questionnaire used in this study as an information gathering tool was designed based upon the conceptual research framework. The questionnaire is divided into three sections: the first section is about the demographic characteristics including gender, age, educational level, job role, years of experience, organisation type and size, and country of practice. The second part is the proposed model construct and is related to organisation capabilities of HP User Acceptance, HP Learning Capability, HP IT Infrastructure and HP HR Capability and the precursors of Service User Acceptance and Telemedicine access. The final section is about the model outputs of HP Operational Capability, Telemedicine Outcome Expectations and Telemedicine Readiness as well as Telemedicine Adoption.

Sekaran (2000) stated that a Likert scale is a common method to collect information from participants in a survey, and it was usually used with either five or seven points in the published literature applicable to the current research. This survey used 1 to 5 Likert scales to study the response of the participants and evaluate it in relation to the framework constructs mentioned earlier, where 1 indicates "strongly disagree" and 5 indicates "strongly agree ".

4.5. Ethical Consideration

Ethical issues are a concern in conducting this research while going through different stages. These include getting access to organisations or individuals, and collecting, analysing, and reporting the data (Bell and Bryman, 2007; Saunders, Lewis, and Thornhill, 2009). Ethical research committees are organisation research bodies authorised to guard the safety, rights, dignity and welfare of the study participants by revising and approving proposed studies especially in the medical field (Denny et al., 2015).

As for this research, an ethical application was submitted firstly to Brunel University research ethics approval committee and secondly to the Libyan Embassy to obtain their approval (Appendix B) for this research and to have access to their database as the

targeted sample was mainly Libyan clinicians who are funded by the Cultural Attaché at the Libyan Embassy in London, UK on training courses and to study for further education in UK educational institutions and who have been healthcare providers in Libya.

Furthermore, the survey contained an explanation of the research purpose and also the contact details of the researcher for the participants if they had to raise any concern. Additionally, the researcher highlighted in the survey that any respondent who is taking part in this research is strictly a voluntary participant and is free to decline at any time. Furthermore, participants are reassured that all responses would be treated confidentially and anonymously with no personal information published.

4.6. Pilot Study

Hulley et al. (2013) define pilot study as a small research directed to accomplish whether a full scale research is achievable and to improve the measurements to optimise the competence of full scale research. According to Saunders, Lewis, and Thornhill (2009), prior to using the questionnaire to collect data it should be pilot tested. The goal of the pilot study is to improve the questionnaire so that participants in the main field survey would have no issues responding to the questions asked and there will be no problems in recording the information as well as testing the reliability of internal consistency.

In this study, a pilot study was carried out and 15 questionnaires were distributed and information was recorded using face-to-face interviews with Libyans, mainly clinicians, who were attending and participating in a conference organised by the Libyan Embassy in London. Table 4.3 shows the sample profile of the pilot study.

Table 4.3: Pilot Study Sample Profile

Characteristic		Frequency	%
Gender	Male	4	26%
	Female	11	74%
Age Range	22-34	13	86%
	35-44	2	14%
Educational Level	Equivalent to BSc	1	7%
	Equivalent to MSc	8	53%
	Equivalent to PhD	6	40%
Years of Experience	1-4	3	20%
	5-10	8	53%
	10-20	4	27%
	20 +	0	0
Organisation Ownership Type	Private Sector	3	20%
	Public Sector	4	27%
	Both Sectors	8	53%
Organisation Size	Small	1	7%
	Medium	2	14%
	Large	12	79%

To examine the internal consistency of the test items, a reliability test was conducted (Nunnally and Bernstein, 1994; Pallant, 2011). Cronbach alpha is a commonly used method to calculate the internal reliability of a test item. As stated by Lee and Hooley (2005), coefficient alpha is used to provide a reliability indication of a scale's (questionnaire with multi items) internal consistency. It has some limitations depending on sample size and the nature of the factor being examined (Tavakol and Dennick,

2011). Cronbach alpha was developed by Lee Cronbach in 1951 to offer a measure of the internal consistency of a test and it is stated as a number between 0 and 1 (Tavakol and Dennick, 2011). Pallant (2011) suggested that a value of 0.70 as threshold for a factor to be retained.

However, Nunnally and Bernstein (1994) recommended that a value of 0.50 to 0.60 is acceptable for the early stages of a research. Therefore, the researcher was satisfied with the current results and progressed to the main field study, which the value of Cronbach alpha of 0.7 and above will be applied as per the study of Health Technology Assessment by Gagnon et al., (2006). Table 4.5 presents the reliability test results for the pilot study.

Table 4.4: Reliability Test for Pilot Study

Constructs	**Cronbach's Alpha (α)**
Service User Acceptance	0.59
Telemedicine Access	0.73
HP User Acceptance	0.817
HP Learning Capability	0.703
HP IT Infrastructure	0.715
HP HR Capability	0.905
HP Operational Capability	0.463
Telemedicine Outcome Expectations	0.858
Telemedicine Readiness	0.657
Telemedicine Adoption	0.738

4.7. Main Field Sample Size Calculation

Bryman and Cramer (2005) stated that to undertake statistical tests, such as factor analysis, reliably, it is important to have an appropriate sample size. Field (2013) defined a sample as a small (yet demonstrative) collection of units from a larger population utilised to establish facts about that population. According to Gill and Johnson (2010), it is not practical to include all members of population in the research. Therefore, it is significant to select a representative sample of the population for the study. Hussey and Hussey (1997) described a population as any specifically-defined set of people or collection of units which is under examination while a sample is a sub-set of the population.

As the sample size increases, the likelihood of attaining statistical significance increases (Cohen, 1988). Saunders, Lewis, and Thornhill (2009) indicated that probability and non-probability sampling techniques are the most widely used techniques. Probability sampling involves using random selection to draw subjects from the targeted population where each set of the population has an equal probability of inclusion in the sample (Bryman and Cramer, 2005). Blumberg et al. (2008) suggested that non-probability is a likely-used technique as far as the time and cost are concerned and it is preferred when targeting certain individuals or organisations (Teddlie and Yu, 2007).

Non-probability sampling is an encompassing term that captures all forms of sampling that are not conducted according to the standards of probability sampling (Bryman and Bell, 2015). Bryman (2015) classified non-probability sampling into three categories, namely: convenience sampling, snowballing (networking) and quota sampling. According to Saunders, Lewis, and Thornhill (2009), convenience sampling is nominated on the basis that the participants are conveniently obtainable and accessible. Convenience sampling technique was chosen as this was applicable in the current research where access to qualified participants is difficult in Libya due to the geopolitical issues over there.

This technique might have a shortfall of data with extended population and it was an opportunity for the researcher, to address the research questions, finding participants with medical backgrounds and who have been working for healthcare providers in Libya and at the same time they are in the UK for short and long training courses or studying for postgraduate degrees. In addition, any thoughts or problems due to a shortfall of the extended population can be addressed through rigorous data analysis such as reliability and construct validity.

Permission was granted to use the Libyan Embassy database in London to send Questionnaires by emails to a population of 620 individuals (mainly clinicians). The total number of population dropped to 520 after excluding undergraduate students group (due to lake of work experience), and the respondent's total was 161 with percentage of 31%. This response rate may limit the study findings in terms of generalising to the extended population and might sway the construct validity process such as factor analysis.

One of the main aspects of planning a research is the calculation of the sample size. Kish (1965) indicated that statistical calculation is used to ensure the chosen sample represents the population. It is been recommended by various researchers that the larger sample size the more representative of the population and the better result's accuracy with minimum error probability. Osborne and Costello (2004) said that there is not many sample size guidelines for scholars and most of these guidelines have little empirical evidence.

To determine the appropriate sample size for studies involving organisations, it has been recommended by Hinkin (1995) that item-to-response ratio could be extending from 1:4 to 1:10 for each set of scales to be factor analysed. On the other hand, Comfrey and Lee (1992) suggest that the adequacy of sample size might be calculated approximately on the following scale: 50 = very poor; 100 = poor; 200 = fair; 300 = good; 500 = very good; $\geq$ 1000 = excellent. It has been observed that a sample size of 150 participants should be sufficient to achieve an accurate result for factor analysis if item correlations are reasonably strong.

Another approach is using Pallant (2013) SPSS statistical guidelines to calculate the sample size (since SPSS software package is used for result analyses in this study) through the following formula:

N > 50 + 8 m; where m is the number of predicting variables.

For this study, N > 50 + 8 (6) = 98 and this sample size is smaller than 161 (the actual sample size of the current research).

Munro (2005) suggested item-to-response ratios of 1:5 as it is generally used by researchers in the field of healthcare and organisations and that is why this sample size technique was perceived appropriate in the current research for factor and regression analysis. A questionnaire is used, and it contains 34 items (variables or sub-construct measurements to predict model outcomes) which were reduced to 31 items by deleting 3 measures in order to improve the Cronbach's Alpha coefficients level. Thus, sample size available for factor analysis would range between 124 and 310 respondents and as a result, the estimated sample size required for this research is 155 participants and this is below the actually collected sample size of 161 which is considered acceptable for exploratory factor analysis (Hinkin, 1995). More details regarding this matter are discussed in chapter six.

4.8. The Case of Libya and its Geopolitical Situation and the Sample Size

Libya with its geopolitical importance in the North African region had been an active member of the Arab spring, yet it has been considered a failed state with unsettled political and security situations after the toppling of Gaddafi. The political instability is considered to be far from resolved and thus the country is in a constant state of civil war with air strikes from international forces against the suspected hideouts of the international terrorist's groups which have led the country to a state where the losses sustained to its politics are irreparable.

Abdessadok (2017) mentioned that the political condition is far from diluting as not one but three governments are in constant state of tug of war for the control of Libya with each having an ally that seeks to create unrest within the country and thus not only depreciating the opposition but also the country as a whole which they seek to rule. There are debates as to whether it is the Libyan government who is in total control of the country or the militants, or who is the more powerful one, yet the country has been considered to be a failed state with not one but multiple candidates who deter the country and its harmony, politics and economy.

The sample size selected for the research is a clear reflection of the current state that prevails in this North African country. In a country where thousands have been displaced and a several hundred have been killed in air strikes, the ascertaining of a substantial sample size is a challenge that is quite difficult to achieve which is why the sample size of the research is as large as could be hoped for by any researcher. It needs to be considered that the research is conducted in a battle struck and war-torn country which is yet to achieve enough stability on multiple grounds so as to be regarded as effectively governed. Therefore, the sample size is limited due to the fact that people in the country are in search of food and shelter and responding to a study and its surveys is the last thing they are expected to be doing. Thus, the sample size has been selected keeping in mind the appalling conditions of the country and the deteriorating state in which the people live with only a few having a well-to-do life and the means to be sustained.

4.9. Chapter Summary

In this chapter, the researcher concentrated on classifying and defining the different research methods such as positivist, interpretivist, qualitative, and quantitative. The understanding of these methods is imperative in helping the researcher to identify the appropriate methods to be applied such as sample choice and size, and then the related analytical methods required to provide a robust analysis of the data obtained.

Chapter Five: Survey Analysis

5.1. Introduction

This study is proposing a conceptual framework to predict Healthcare Provider (HP) Operational Capability, Telemedicine Outcome Expectations, Telemedicine Readiness and Telemedicine Adoption at an organisational level in developing countries.
A questionnaire-based survey was designed and developed based on the conceptual framework's core constructs. Field research was conducted in the UK distributing the questionnaire by emails obtained from a database of 620 individuals at the Libyan Embassy, Cultural Affairs Department targeting healthcare professionals and mainly Libyan clinicians who are attending short-term training courses or studying for further education in the UK and who have been working with healthcare providers such as hospitals and private clinics in Libya. The healthcare professionals are determinant front line staff and key players to adopt e-Health systems and to use Telemedicine applications. The total number of participants dropped to 520 after excluding undergraduate students group, and the respondent's total was 161 with percentage of 31%.

5.2. Effect of Demographics characteristics on model outputs

One of the aims of this research is to discover the difference observed between respondents towards HP Operational Capability, Telemedicine Outcomes Expectation, Telemedicine Readiness, and e-Health & Telemedicine Adoption in Libya on the basis of their demographic characteristics such as age, gender, educational level, years of experience, healthcare providers' size, participants' country of practice and Telemedicine type used. To study the effects of these demographic characteristics on the Telemedicine outputs, some tests were applied.

Foster (2001), stated that t-test and one-way ANOVA test are suitable data analysis methods for such analysis. These tests are to find if there are any differences among the demographics, and other respondents' characteristics on the model outputs.

5.2.1. Sample Profile

Participants' gender and age range

Figure 5.1 shows that women respondents in this study form 52% compared to 48% men out of 161 participants. The age range groping was based on previous studies in healthcare sector such as the research of Mindel et al. (2009). Almost half the respondents are in age range (22-34) years old forming 50%, followed by (35-44) years old representing 36%, then (45-54) years old group with 11%, while the percentage of the (21 and under, and 55 and over) groups were 1% and 2% respectively.

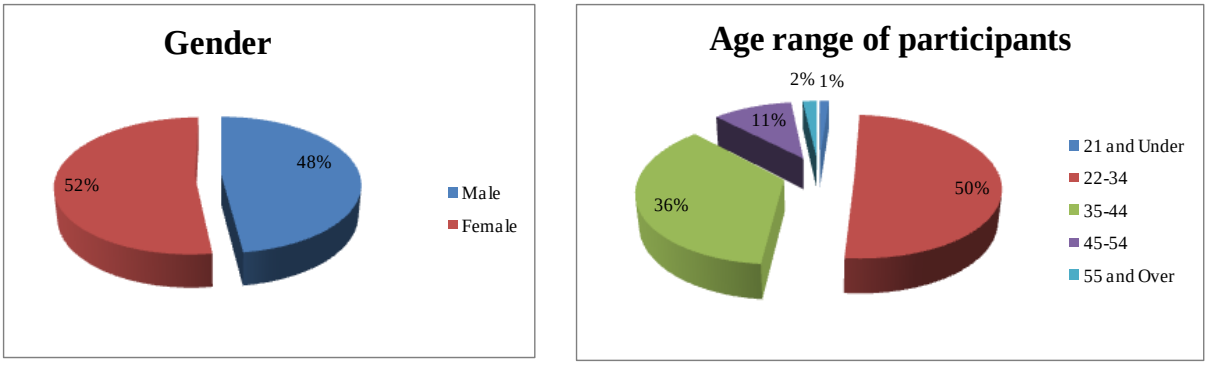
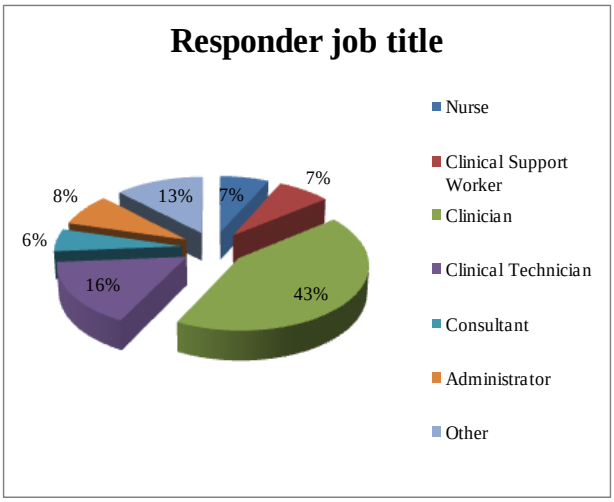


Figure 5.1: Gender and age range of participants

Job role and education level

The clinicians and clinical technicians represented the majority of this cohort (59%). The rest of the participants (41%) were working as: nurses, clinical support workers, consultants, administrators and other jobs in healthcare. Participants hold different education levels, these were, in descending order: BSc (39.1%), MSc (32.3%) and PhD (28.6%) respectively (Figure 5.2).



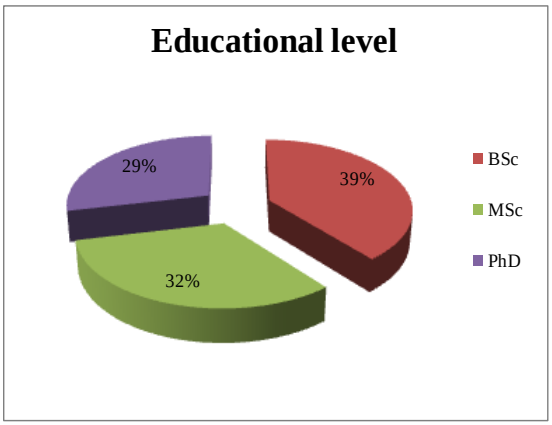


Figure 5.2: Job role of participants and education level of participants

Healthcare provider's clinical experience

Figure 5.3, demonstrates the distribution of the years of clinical experience of participants. 65/161 participants (40%) had an average of clinical experience between 5-10 years, followed by (32%) with 1-4 years of experience, and (24%) who had 10-20 years of experience. Only 6/161 people (4%) had over 20 years of clinical experience.

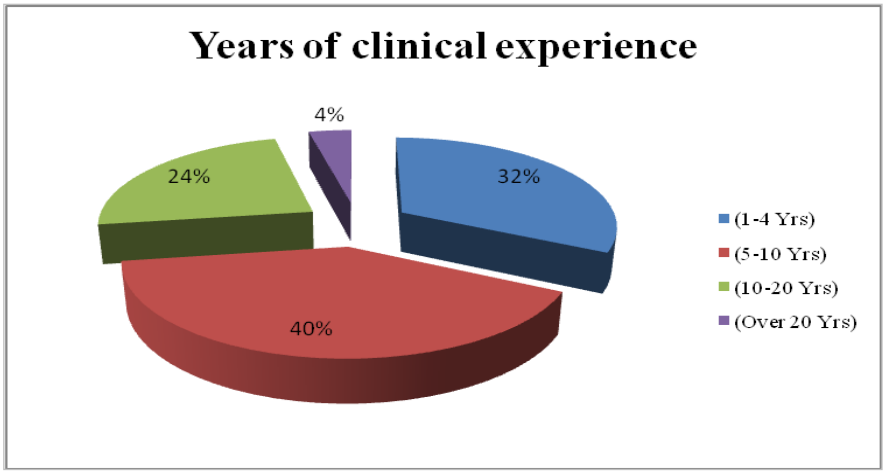


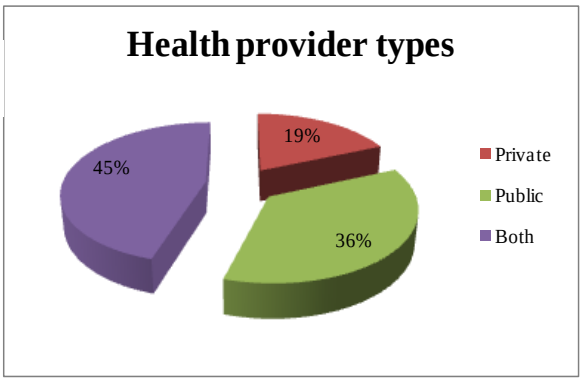
Figure 5.3: Distribution of clinical experience of participants

Health providers' types, sizes and country of practice

Figure 5.4 (A), shows that 45% of health providers were working in both healthcare sectors (private and public), and about 36% of the participants were employed at public healthcare sectors. The rest of the participants worked in private healthcare centres. Moreover, (Figure 5.4 B) revealed that 44% of individuals were working in large healthcare organisations [> 500], 37% in medium-sized [≥ 51 ≤ 250], and 19% were working in small size [small < 50] healthcare centres.

The participants who worked in Libya presented the highest population (78%) and those working in the UK represented (13%) of the total of our participants (Figure 5.4 C).

A)



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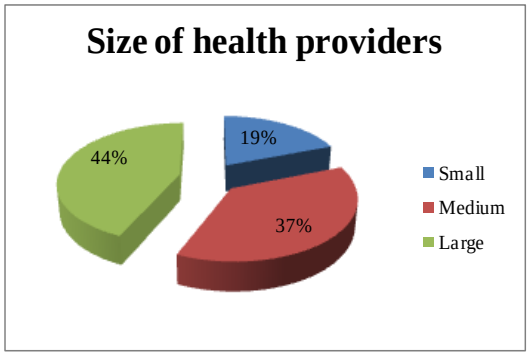

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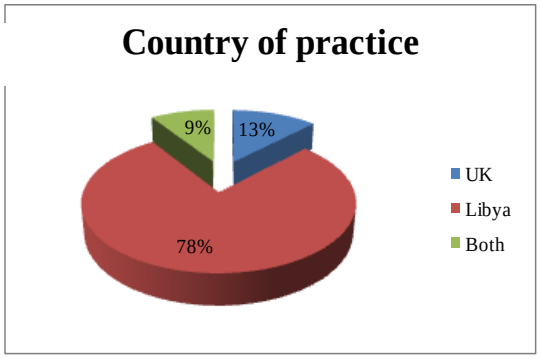
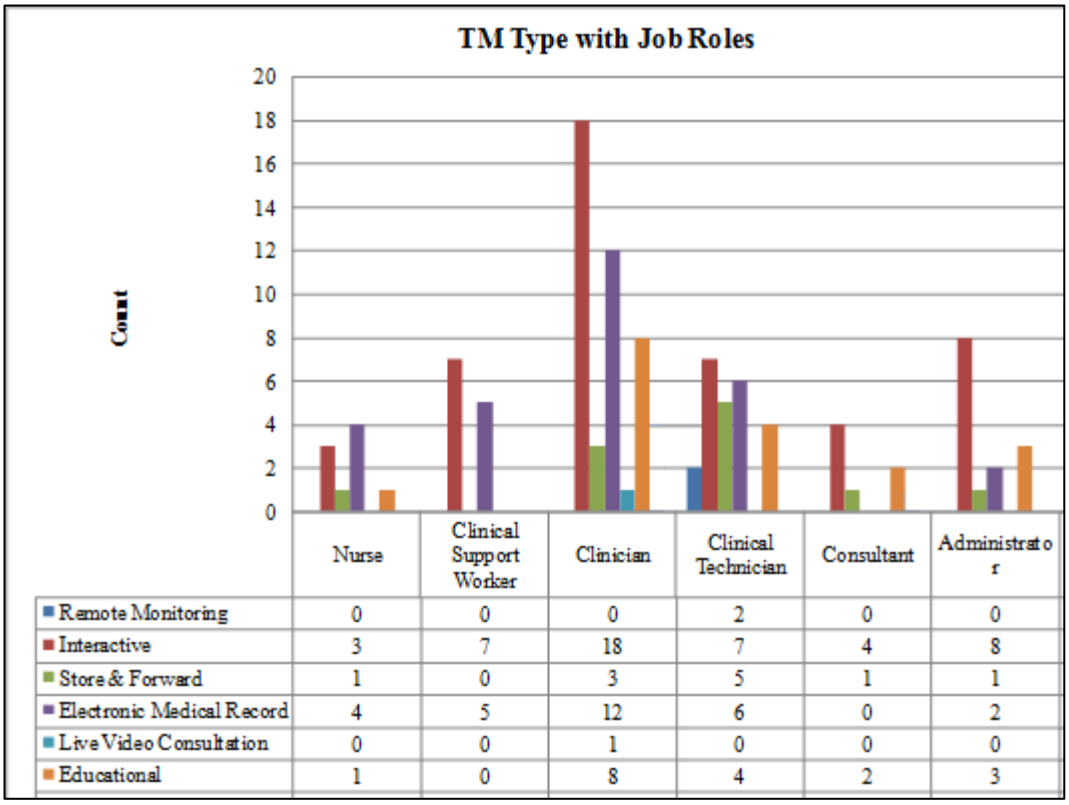


Figure 5.4: Healthcare providers' types, sizes and country of practice

Type of Telemedicine used with HP job roles and HP size

As shown in Figure 5.5, the types of Telemedicine most used by healthcare providers are interactive, electronic medical record and educational. The respondents indicated little use of remote monitoring and live video consultations were not used by the participants.



	Nurse	Clinical Support Worker	Clinician	Clinical Technician	Consultant	Administrator
Remote Monitoring	0	0	0	2	0	0
Interactive	3	7	18	7	4	8
Store & Forward	1	0	3	5	1	1
Electronic Medical Record	4	5	12	6	0	2
Live Video Consultation	0	0	1	0	0	0
Educational	1	0	8	4	2	3

Figure 5.5: Telemedicine types used by participants' job roles

Clinicians are the largest users of interactive technologies, followed by administrators, clinical technicians, clinical support workers (under the supervision of clinicians) and then nurses. In the same order, apart from administrators, comes the use of electronic medical records.

In Figure 5.6 shown below, the most used Telemedicine types in different-sized healthcare providers are interactive technologies such as telephones and emails, electronic medical record, educational and store and forward. The respondents from different HP sizes indicated little use of remote monitoring and live video consultations were not used by the participants.

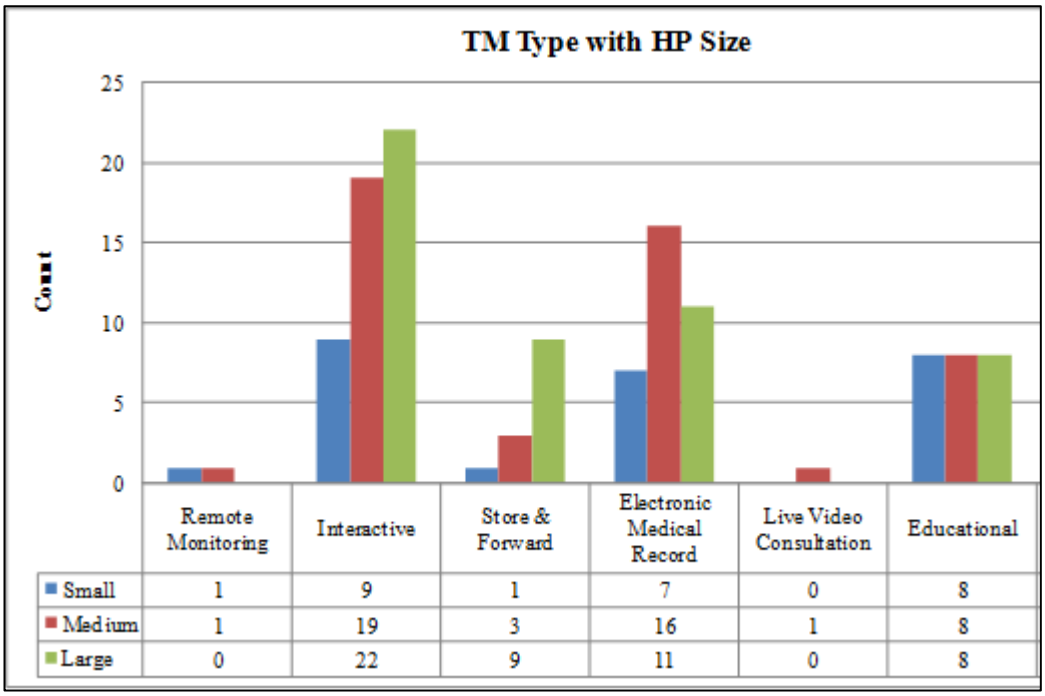


Figure 5.6: Telemedicine Types used by HP Size

The most used Telemedicine type is interactive in large and medium-sized healthcare providers compared to small-sized healthcare providers.

5.3. Sample profile variables and model's outputs

5.3.1. Influence of participants' gender on model outputs

An independent-samples t-test was conducted to compare the mean scores for the two groups and report the significance of their differences (Pallant, 2011). The result of independent t-test was performed in term to detect any existing relationship between the healthcare provider staff's gender and the model's outputs, and p values were not statistically significant ($p > 0.05$) as shown in table 5.1 and Figure 5.7.

Table 5.1: Influence of gender of participants on model's outputs

	Gender	N	Mean	Std. Deviation	P value
HP Operational Capability	Male	77	3.8052	.67180	0.186
	Female	84	3.9405	.61911	
Telemedicine Outcome Expectation	Male	77	4.0455	.79086	0.056
	Female	84	4.2599	.61624	
Telemedicine Readiness	Male	77	3.3377	.63636	0.872
	Female	84	3.3472	.58838	
Telemedicine Adoption	Male	77	3.8909	.64689	0.966
	Female	84	3.8952	.63510	

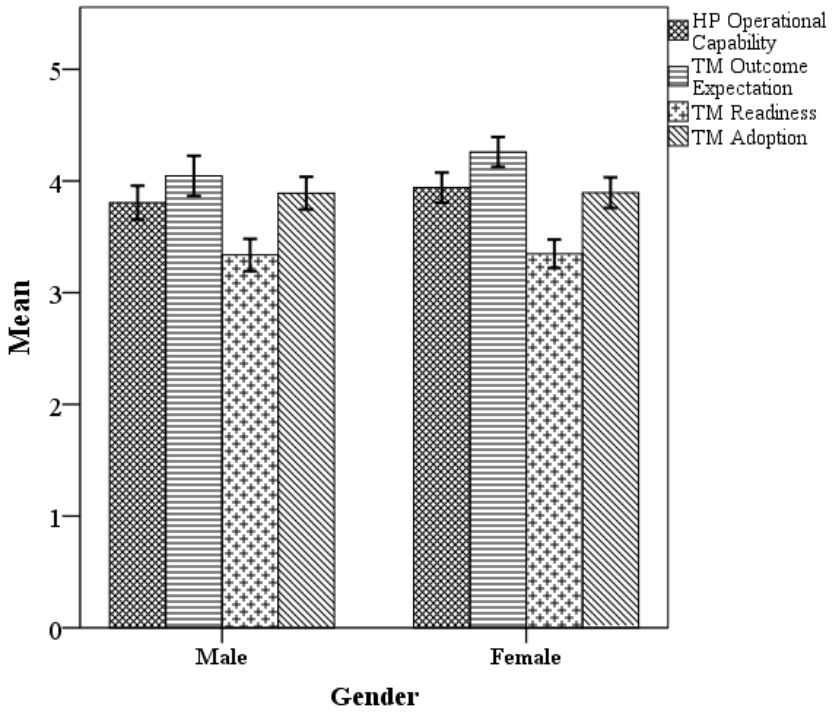


Figure 5.7: Participants' gender and model's outputs

The findings suggest that model's outputs HP Operational Capability, Telemedicine Outcome Expectation, Telemedicine Readiness, and Telemedicine Adoption were not influenced by gender in this study and are not to be further examined in this research. It should be noted that Telemedicine outcome expectation had p values = 0.056 and it might become statistically significant with a larger sample size.

5.3.2 Influence of age range of participants on model's outputs

Analysis of variance (ANOVA) test was performed to identify differences in mean of model outcome based on age range groups in this study. Table 5.2 and Figure 5.8, indicate that the mean ± SD for participants age range was 22-34 years old (4.11±0.67), 35-44 years old (4.19±0.77), 45-54 years old (4.27±0.67) and 55 & over (4.33±0.57). The age range groups of participants and Telemedicine Readiness were statistically significant (p= 0.046).

Thus post hock test (Table 5.3) was applied to investigate which age range group has effect on Telemedicine readiness and the finding was that the age range 35-44 group was more optimistic regarding Telemedicine Readiness compared with the age range 22-34 group.

Table 5.2: ANOVA test comparing age range of participants based on model's outputs

		df	F	Sig.
HP Operational Capability	Between Groups	4	.726	.576
	Within Groups	156		
	Total	160		
Telemedicine Outcome Expectation	Between Groups	4	.806	.523
	Within Groups	156		
	Total	160		
Telemedicine Readiness	Between Groups	4	2.483	**.046***
	Within Groups	156		
	Total	160		
Telemedicine Adoption	Between Groups	4	1.791	.133
	Within Groups	156		
	Total	160		

*. The mean difference is significant at the 0.05 level.

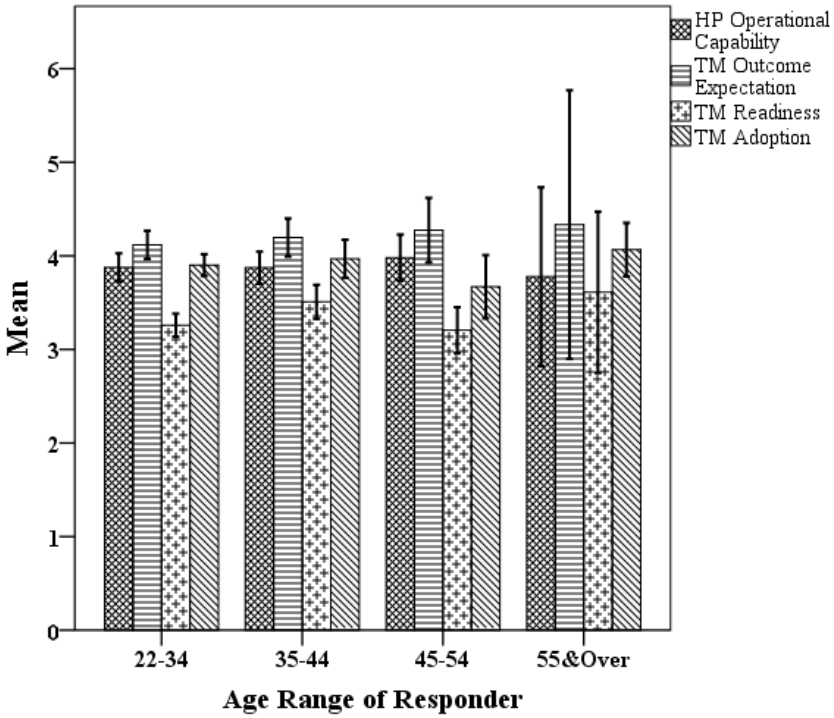


Figure 5.8: Age range of participants and model's outputs

Table 5.3: Post-Hoc test comparing participants' age range based on Telemedicine Readiness

Dependent Variable: Telemedicine Readiness

(I) Age Range of Participants	(J) Age Range of Participants	Mean Difference (I-J)	Sig.
22-34 years old	35-44 years old	-.24319*	**.019***
	45-54 years old	.05955	.708
	55 and over	-.34568	.325
35-44 years old	22-34 years old	.24319*	**.019***
	45-54 years old	.30274	.067
	55 years old and over	-.10249	.772
45-54 years old	22-34 years old	-.05955	.708
	35-44 years old	-.30274	.067
	55 years old and over	-.40523	.279
55 years old and over	22-34 years old	.34568	.325
	35-44 years old	.10249	.772
	45-54 years old	.40523	.279

*. The mean difference is significant at the 0.05 level.

5.3.2. Influence of job role of participants on model's outputs

Table 5.4 and Figure 5.9, reveal that the different job role groups (7% nurses, 7% clinical support workers, 43% clinicians, 16% clinical technicians, 6% consultants and 9% administrators) in this research responded similarly to the main four outcomes of this study and job role did not have any impact on the results, and p values were > 0.05.

Table 5.4: ANOVA test comparing job role of participants based on model's outputs

		df	F	Sig.
HP Operational Capability	Between Groups	7	1.411	.204
	Within Groups	153		
	Total	160		
Telemedicine Outcome Expectation	Between Groups	6	.686	.662
	Within Groups	154		
	Total	160		
Telemedicine Readiness	Between Groups	6	1.077	.379
	Within Groups	154		
	Total	160		
Telemedicine Adoption	Between Groups	6	.271	.950
	Within Groups	154		
	Total	160		

*. The mean difference is significant at the 0.05 level.

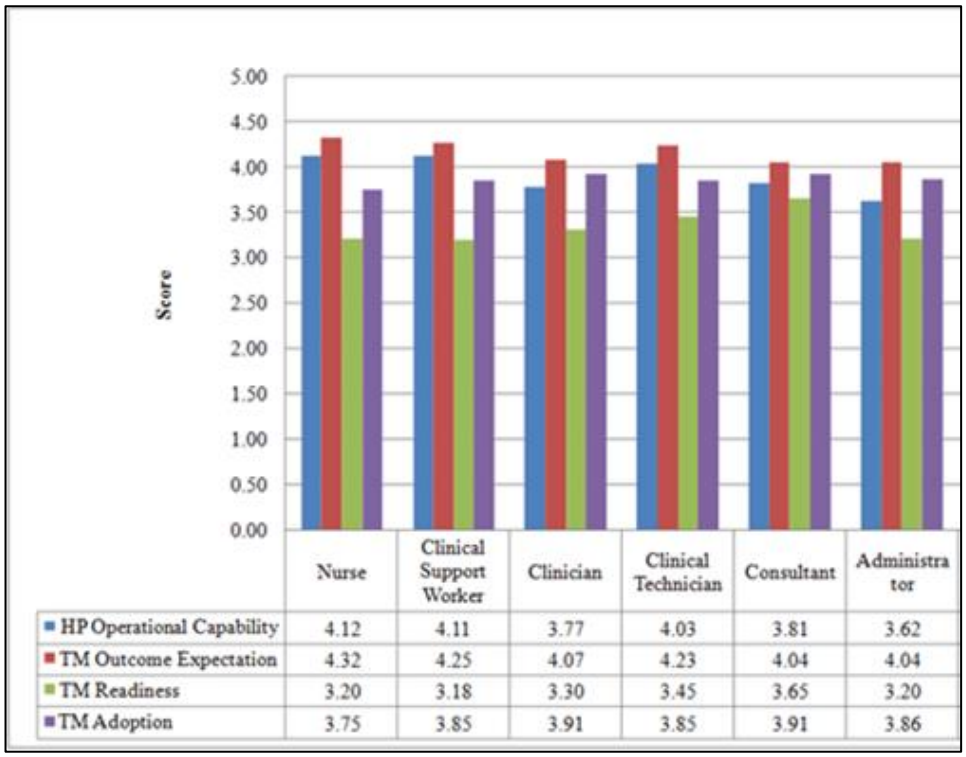


Figure 5.9: Model's outputs by participants' job roles

5.3.3. Influence of participants' education level on model's outputs

Even though the participants were at different levels of their educational background such as Bachelor, Master and PhD degree holders, Table 5.5 and figure 5.10, illustrate that there were not statistical differences in their responses in term of Telemedicine outcome expectation, Telemedicine readiness and Telemedicine adoption, as p values were 0.190, 0.069, and 0.089 respectively.

Table 5.5: ANOVA test comparing education level based on model's output

		df	F	Sig.
HP Operational Capability	Between Groups Within Groups Total	2 158 160	.157	.855
Telemedicine Outcome Expectation	Between Groups Within Groups Total	2 158 160	1.677	.190
Telemedicine Readiness	Between Groups Within Groups Total	2 158 160	2.724	.069
Telemedicine Adoption	Between Groups Within Groups Total	2 158 160	2.452	.089

*. The mean difference is significant at the 0.05 level.

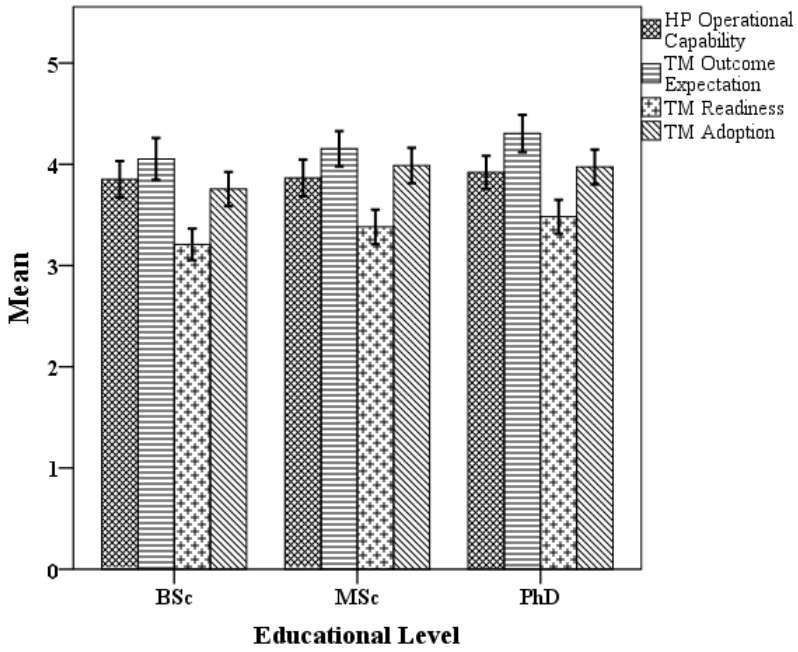


Figure 5.10: Participants' education level and model outputs

5.3.4. Influence of participants' years of experience on model's outputs

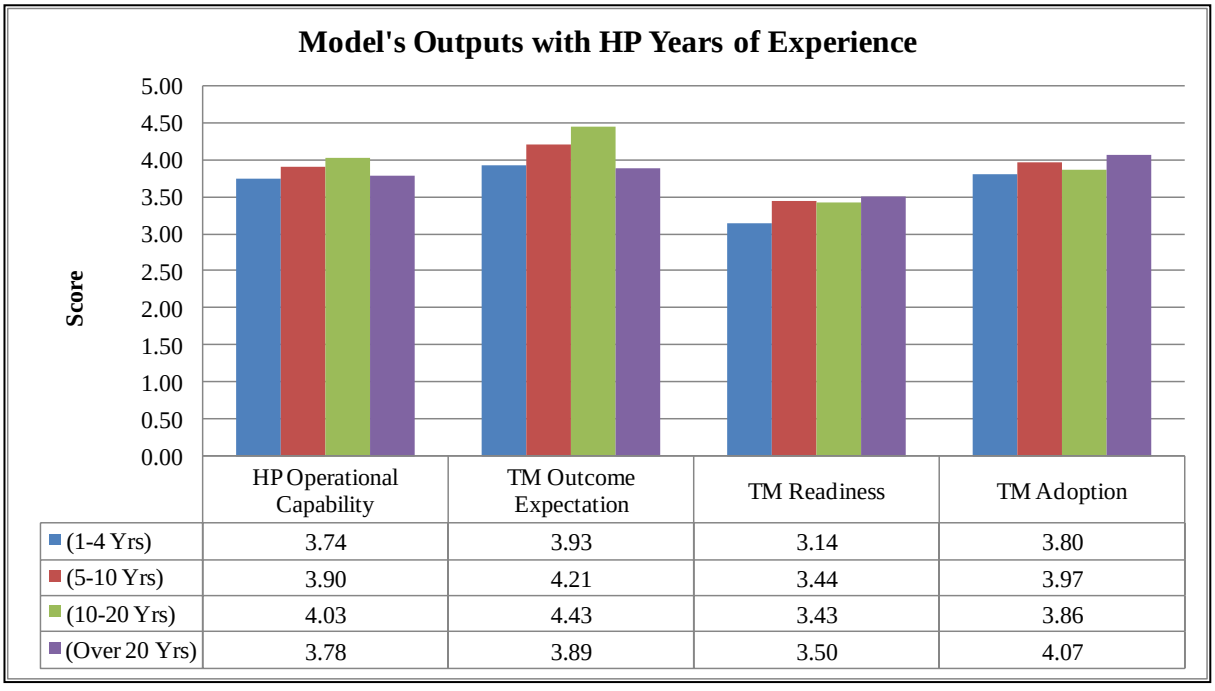
Years of experience groups in this research (1-4, 5-10, 10-20, and 20+) behave differently in terms of the model's outputs. Figure 5.11, shows that the mean difference in Telemedicine outcome expectation was high and Table 5.6 illustrates (p= 0.005) between groups on Telemedicine outcome expectation, and (p= 0.044) between groups on Telemedicine readiness. However, Telemedicine adoption mean differences between groups were not significant ($p > 0.05$).

Multiple comparison data in Table 5.7 and Table 5.8 shows that (5-10 years, and 10-20 years) groups had positive support toward the Telemedicine outcome expectation (p= 0.031, p= 0.001, respectively) and Telemedicine readiness (p=0.010, p=0.033) compared with the less experienced group (1-4 years).

Table 5.6: ANOVA test comparing participants' years of experience based on model's output

		df	F	Sig.
HP Operational Capability	Between Groups Within Groups Total	3 157 160	1.509	.214
Telemedicine Outcome Expectation	Between Groups Within Groups Total	3 157 160	4.397	**.005***
Telemedicine Readiness	Between Groups Within Groups Total	3 157 160	2.762	**.044***
Telemedicine Adoption	Between Groups Within Groups Total	3 157 160	.794	.499

*. The mean difference is significant at the 0.05 level.



	HP Operational Capability	TM Outcome Expectation	TM Readiness	TM Adoption
(1-4 Yrs)	3.74	3.93	3.14	3.80
(5-10 Yrs)	3.90	4.21	3.44	3.97
(10-20 Yrs)	4.03	4.43	3.43	3.86
(Over 20 Yrs)	3.78	3.89	3.50	4.07

Figure 5.11: Participants' years of experience on model's outputs

Table 5.7: Post-Hoc test comparing participants' years of experience based on Telemedicine Outcome Expectation

Dependent Variable: Telemedicine Outcome Expectation

(I) Years of Clinical Experience	(J) Years of Clinical Experience	Mean Difference (I-J)	Sig.
(1-4 years)	(5-10 years)	-.27885*	**.031***
	(10-20 years)	-.50793*	**.001***
	(Over 20 years)	.03739	.900
(5-10 years)	(1-4 years)	.27885*	**.031***
	(10-20 years)	-.22908	.106
	(Over 20 years)	.31624	.284
(10-20 years)	(1-4 years)	.50793*	**.001***
	(5-10 years)	.22908	.106
	(Over 20 years)	.54532	.074
(Over 20 years)	(1-4 years)	-.03739	.900
	(5-10 years)	-.31624	.284
	(10-20 years)	-.54532	.074

*. The mean difference is significant at the 0.05 level.

Table 5.8: Post-Hoc test comparing participants' years of experience based on Telemedicine Readiness

Dependent Variable: Telemedicine Readiness

(I) Years of Clinical Experience	(J) Years of Clinical Experience	Mean Difference (I-J)	Sig.
(1-4 years)	(5-10 years)	-.29038*	**.010***
	(10-20 years)	-.27480*	**.033***
	(Over 20 years)	-.34936	.177
(5-10 years)	(1-4 years)	.29038*	**.010***
	(10-20 years)	.01559	.898
	(Over 20 years)	-.05897	.817
(10-20 years)	(1-4 years)	.27480*	**.033***
	(5-10 years)	-.01559	.898
	(Over 20 years)	-.07456	.777
(Over 20 years)	(1-4 years)	.34936	.177
	(5-10 years)	.05897	.817
	(10-20 years)	.07456	.777

*. The mean difference is significant at the 0.05 level.

5.3.5. Influence of healthcare provider ownership on model's outputs

Figure 5.12 and Table 5.9 demonstrate the three types of healthcare providers such as public healthcare, private healthcare and healthcare providers working in both. The private healthcare group shows a significant result for Telemedicine outcome expectation (p= 0.042). Table 5.10 displays that the healthcare providers who worked in private healthcare centres were less supportive than staff who were working in both (public and private). The Telemedicine readiness and Telemedicine adoption were not statistically significant (p= 0.512, p= 0.264).

Table 5.9: ANOVA test comparing participants' healthcare provider ownership based on model's outputs

		df	F	Sig.
HP Operational Capability	Between Groups	2	0.350	0.075
	Within Groups	158		
	Total	160		
Telemedicine Outcome Expectation	Between Groups	2	3.236	**.042***
	Within Groups	158		
	Total	160		
Telemedicine Readiness	Between Groups	2	.673	.512
	Within Groups	158		
	Total	160		
Telemedicine Adoption	Between Groups	2	1.343	.264
	Within Groups	158		
	Total	160		

*. The mean difference is significant at the 0.05 level.

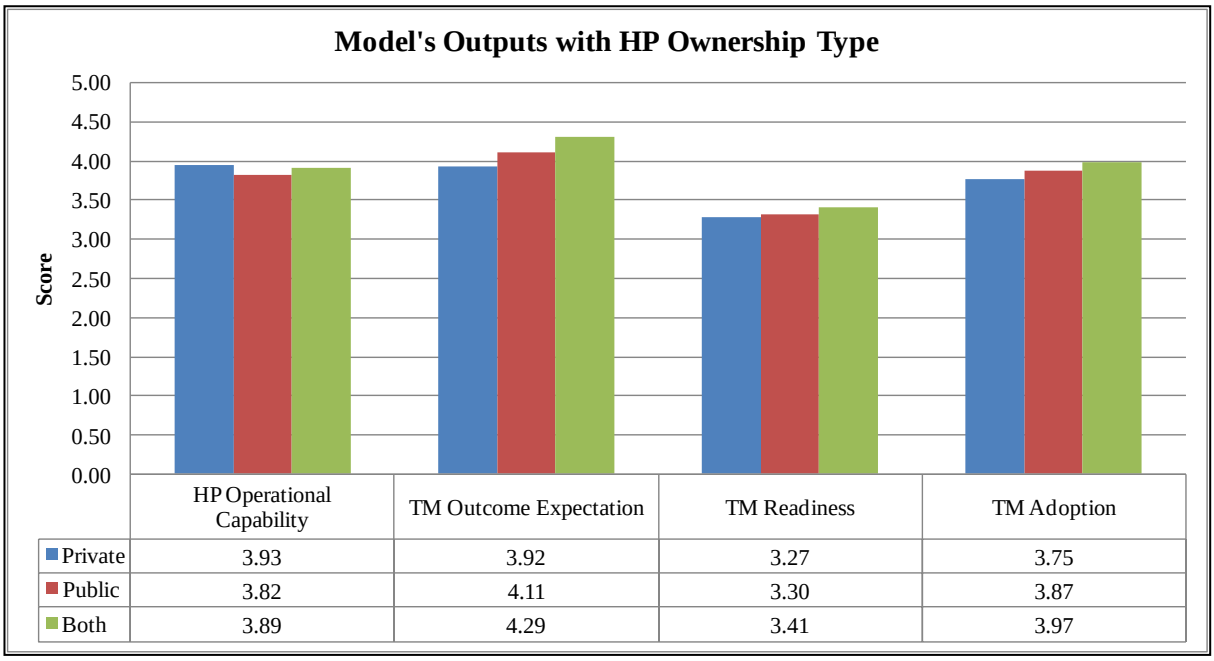


Figure 5.12: Healthcare provider ownership type by models' output

Table 5.10: Post-Hoc test comparing participants' HP ownership type based on Telemedicine Outcome Expectation

Dependent Variable: Telemedicine Outcome Expectation

(I) Health Provider Type	(J) Health Provider Type	Mean Difference (I-J)	Sig.
Private	Public	-.18410	.245
	Both	-.37230*	**.015***
Public	Private	.18410	.245
	Both	-.18820	.129
Both	Private	.37230*	**.015***
	Public	.18820	.129

*. The mean difference is significant at the 0.05 level.

5.3.6. Influence of size of health provider on model's outputs

Table 5.11, 5.12 and Figure 5.13 show that the different sizes of healthcare provider's groups such as: small [< 50], medium [≥ 51 ≤ 250] and large [> 500] all had significant results with the model outcomes: Telemedicine outcome expectation, Telemedicine readiness and Telemedicine adoption (p= 0.029, p= 0.006 and p= 0.041) respectively. Large-sized groups were more positive toward Telemedicine outcome expectation compared to medium and small groups, and p value were < 0.05 respectively. The small-sized health provider group showed their support to the Telemedicine readiness and Telemedicine adoption more than medium-sized health provider group.

Table 5.11: ANOVA test comparing participants' healthcare provider size based on model's outputs

		df	F	Sig.
HP Operational Capability	Between Groups Within Groups Total	2 158 160	.313	.732
Telemedicine Outcome Expectation	Between Groups Within Groups Total	2 158 160	3.607	**.029***
Telemedicine Readiness	Between Groups Within Groups Total	2 158 160	5.327	**.006***
Telemedicine Adoption	Between Groups Within Groups Total	2 158 160	3.257	**.041***

*. The mean difference is significant at the 0.05 level.

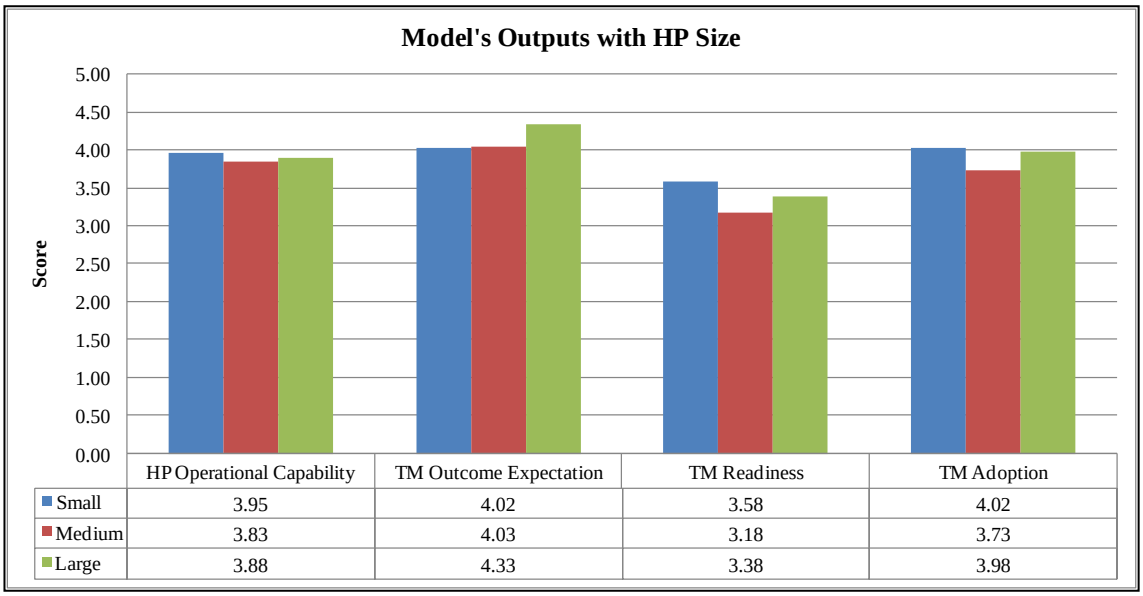


Figure 5.13: Model's outputs by HP size

Table 5.12: Post-Hoc test comparing participants' HP ownership size based on Telemedicine Outcome Expectation, Telemedicine Readiness and Telemedicine Adoption

Dependent Variable: Telemedicine Outcome Expectation, Telemedicine Readiness and Telemedicine Adoption

Dependent Variable	(I) Number of Employees	(J) Number of Employees	Mean Difference (I-J)	Sig.
Telemedicine Outcome Expectation	Small	Medium	-.00905	.953
		Large	-.30469*	**.045***
	Medium	Small	.00905	.953
		Large	-.29563*	**.017***
	Large	Small	.30469*	**.045***
		Medium	.29563*	**.017***
Telemedicine Readiness	Small	Medium	.41900*	**.002***
		Large	.21820	.089
	Medium	Small	-.41900*	**.002***
		Large	-.20079	.055
	Large	Small	-.21820	.089
		Medium	.20079	.055
Telemedicine Adoption	Small	Medium	.28935*	**.039***
		Large	.04221	.757
	Medium	Small	-.28935*	**.039***
		Large	-.24714*	**.027***
	Large	Small	-.04221	.757
		Medium	.24714*	**.027***

*. The mean difference is significant at the 0.05 level.

5.3.7. Influence of health provider's country of practice on model's output

Healthcare provider's countries of practice were grouped into UK, Libya and both. Table 5.13 and Figure 5.14 illustrate that there was no statistical significance (p value was more than 0.05) between these groups with Telemedicine outcome expectation, Telemedicine readiness and Telemedicine adoption.

Table 5.13: ANOVA test comparing participants' healthcare provider's country of practice based on model's outputs

		df	F	Sig.
Telemedicine Outcome Expectation	Between Groups	2	.795	.454
	Within Groups	158		
	Total	160		
Telemedicine Outcome Expectation	Between Groups	2	.455	.635
	Within Groups	158		
	Total	160		
Telemedicine Readiness	Between Groups	2	.644	.526
	Within Groups	158		
	Total	160		
Telemedicine Adoption	Between Groups	2	2.697	.070
	Within Groups	158		
	Total	160		

*. The mean difference is significant at the 0.05 level.

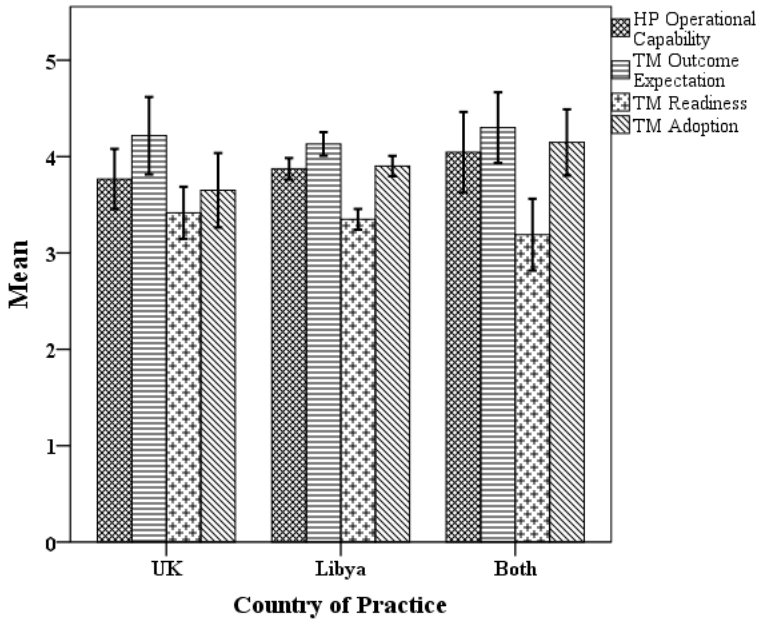


Figure 5.14: Health provider's country of practice and model's outputs

5.4. Summary of Findings

In summary, a number of t-tests and ANOVA tests were performed and presented in this section. Table 5.25 summarises the results of these tests.

Table 5.14: Summary of findings

Test	Sample Profile	Model Outputs	Level of Significant	Finding
t-test	Participants' Gender	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Readiness	Not Significant ($p>0.05$)	No difference was detected
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected
ANOVA	Participants' Age Range	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Readiness	Significant ($p = 0.046 > 0.05$)	Between Age Range (22-34), (35-44) and (45-54)
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected
ANOVA	Participants' Job Role	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Readiness	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected
ANOVA	Participants' Education Level	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Readiness	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected

ANOVA	Participants' Years of Experience	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Significant (P = 0.005)	Between (1-4 years) groups and (5-10years) + (10-20 years) groups
		Telemedicine Readiness	Significant (P = 0.044)	Between (1-4 years) groups and (5-10years) + (10-20 years) groups
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected
ANOVA	HP Ownership Type	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Significant (P = 0.042)	Between groups who are working in private sectors and groups who are working in both (private and public sectors)
		Telemedicine Readiness	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected
ANOVA	HP Size	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Significant (P = 0.029)	Between groups working in large size HP and groups working in small and medium sizes HP
		Telemedicine Readiness	Significant (P = 0.006)	Between groups working in medium size HP and groups working in small size HP.
		Telemedicine Adoption	Significant (P = 0.041)	Between Small size vs medium. And between Medium vs Large
ANOVA	Participants' Country of Practice	HP Operational Capability	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Outcome Expectation	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Readiness	Not Significant ($p > 0.05$)	No difference was detected
		Telemedicine Adoption	Not Significant ($p > 0.05$)	No difference was detected

5.5. Chapter Summary

This chapter examined how participants from healthcare providers responded to the research questionnaire. The chapter covered the analysis of data using t-test and ANOVA test to discover the differences between respondents towards model's outputs outcomes. The charts in this chapter showed that there are differences in age range, years of experience and healthcare provider's size and ownership types which had influences on the model's outputs. It further showed that the size of healthcare providers plays a role in the model's outcomes in this research.

Chapter Six: Model Testing

6.1. Introduction

The current chapter is introducing several stages of the model and tests applied in the research. The aim of this study is to investigate and develop a conceptual framework model for Telemedicine acceptance and the associated organisational capabilities for e-Health and Telemedicine technologies conducting a range of statistical testing including, reliability test, correlation test, factor analysis (PCA) and regression analysis tests. The framework of this study was constructed, preliminary, from related literatures and will be statistically tested through the above-mentioned tests and regression analysis. These tests are to determine the relationships among variables. The regression test is applied when examining the effect of independent variables on dependent variables. The dependent and independent variables can be defined according to what stages in the model are being tested for regression analysis. To achieve those aims, a field research was conducted in the UK distributing a questionnaire targeting mainly Libyan clinicians who are studying for further education in the UK and who have been healthcare providers in Libya. The number of respondents for this research is (N=161).

6.2. Data Screening

Studies about establishing a new services or tools in any organisation and research in social science are mainly on survey-based questionnaires (Sekaran, 2000). According to Tabachnick and Fidell (2007) "*in the survey research the missing problems occur when the respondents cannot answer one or more questions in the questionnaire, thus causing potential problems in the statistical analysis process*". In this study, any questionnaires which were not completed by the respondents were discarded.

6.3. Test of Normality

Normality is defined by the assumption that the shape of the data distribution is a symmetrical and bell-shaped curve (Hair et al., 2010; Pallant, 2011). An assessment of the normality of data is a requirement for various statistical tests since normal data is a fundamental assumption in parametric testing. There are two main methods of assessing normality: numerically and graphically. The shape of the distribution could be measured by kurtosis and skewness. Values of skewness and kurtosis ranging between ±1 present a normal distribution (Hair et al., 2010). Skewness is an indication of the symmetry of

the distribution, whereas, Kurtosis refers to the peakedness or flatness of the distribution compared to the normal distribution (Pallant, 2011; Hair et al., 2010). Tabachnick and Fidell (2007) stated that "*with reasonably large samples, skewness will not make a substantive difference in the analysis, but kurtosis can result in an underestimate of the variance*". Furthermore, Hair et al. (2010) argued that "*the severity of normality is based on the sample size, which reduces the negative effects of non-normality*". According to Tabachnick and Fidell (2007), in the presence of a large sample size, the implication of the level of skewness is not as important as its actual size, and the impact of departure from zero kurtosis also minimises. In this research, the practical sample size is 161 participants, as shown in Table (6.1). Normality plots for all model factors are shown in Appendix D.

Table 6.1: Shape of data distribution, based on Skewness and Kurtosis values

Model Constructs	N	Mean	Std. Deviation	Skewness	Kurtosis
Service User Acceptance	161	18.52	3.166	-.080	-.373
Telemedicine Access	161	20.07	3.924	-.360	.607
HP User Acceptance	161	27.61	4.676	-.543	.448
HP Learning Capability	161	17.19	2.774	-.368	.170
HP IT Infrastructure	161	13.44	4.411	.485	.114
HP Human Resources Capability	161	22.26	4.519	-.876	.227
HP Operational Capability	161	15.75	2.500	-.481	.787
Telemedicine Outcome Expectations	161	24.94	4.267	-.041	.187
Telemedicine Readiness	161	20.00	3.803	-.295	0.019
Telemedicine Adoption	161	19.47	3.194	-.842	.162

Skewness should be zero and not more than 1.9. The negative value means the cluster is on the right of the graph. Kurtosis is similar, however the positive value means that the cluster is rather peaked and not flat.

6.4 Testing for Multicollinearity

Multicollinearity refers to the correlation being high among independent (predictor) variables which are supposed to predict dependent variables and it is been defined by Pallant (2011) as "*the relationship among the independent variables*". Multicollinearity might affect the statistical results and regression as it could be difficult to differentiate the influence of a variable that shows multicollinearity in predicting the relationship

impact in regression analysis (Hair et al., 2010). In order to examine multicollinearity between the predictor variables, a correlation matrix should be checked, and both Tolerance and Variance inflation factor (VIF) should be applied. Pallant (2011) defines Tolerance as "*how much of the variability of the specified independent is not explained by the other independent variables in the model*", and Variance inflation factor (VIF) as "*just the inverse of the Tolerance value*". In this research, the multicollinearity results revealed that the Tolerance results for HP User Acceptance, HP Learning Capability, HP IT Infrastructure, and HP HR Capability are all bigger than 0.1 and their VIF values are less than 10, as shown in Table (6.2) below and as shown in the Pearson's correlation Table 6.4. Hence, there were no multicollinearity concerns (Pallant, 2011).

Table 6.2: Multicollinearity Test

Model middle factors	Tolerance	VIF
HP User Acceptance	.589	1.698
HP Learning Capability	.742	1.347
HP IT Infrastructure	.811	1.233
HP Human Resources Capability	.698	1.432

6.5 Test of Reliability

According to Pallant, (2011), reliability refers to the degree to which the items of the scale are correlated, measuring the same constructs. As suggested by Field (2013), every test score is influenced by different factors. The true score is one, which is based on all factors associated with consistency. The reliability test in a research is conducted to check the extent to which the results represent random measurement error. It is thought that the reliability test is a content validity (during a transitional process to validate the questionnaire as a measurement tool used for data collection in this research) which comes as part of construct validity of a measurement such as a questionnaire (Field, 2013; Trochim, 2006). If there is no reliability validation in the measurement, it might not be possible to conclude that the results are accurate (Trochim, 2006). In the current study, the reliability test has been conducted to examine the consistency of the research's questionnaire. Cronbach's alpha is thought to be easy to calculate and most commonly used among academic researches for testing data reliability (Tabachnick and Fidell, 2007). According to Pallant, (2011), the values of alpha should not be less than 0.70.

Table 6.3: Cronbach's alpha coefficient results for survey

Model Constructs	No. Measures	Measure Code	Alpha if Deleted	Cronbach Alpha (α)
Service User Acceptance	1	SUA1	0.640	0.680
	2	SUA2	0.508	
	3	SUA3	0.645	
	4	SUA4	0.619	
	~~5~~	~~SUA5~~	**0.704**	
HP Telemedicine Access	6	TMA1	0.769	0.781
	7	TMA2	0.719	
	8	TMA3	0.738	
	9	TMA4	0.741	
	10	TMA5	0.778	
	11	TMA6	0.740	
HP User Acceptance	12	PUA1	0.864	0.877
	13	PUA2	0.846	
	14	PUA3	0.848	
	15	PUA4	0.864	
	16	PUA5	0.859	
	17	PUA6	0.867	
	18	PUA7	0.865	
HP Learning Capability	~~19~~	~~PLC1~~	0.777	0.733
	20	PLC2	0.716	
	21	PLC3	0.658	
	22	PLC4	0.640	
	23	PLC5	0.628	
HP IT Infrastructure	24	ITI1	0.856	0.866
	25	ITI2	0.836	
	26	ITI3	0.840	
	27	ITI4	0.824	
	28	ITI5	0.833	
HP Human Resources Management Capability	29	HRC1	0.859	0.877
	30	HRC2	0.858	
	31	HRC3	0.854	
	32	HRC4	0.836	
	33	HRC5	0.844	
	~~34~~	~~HRC6~~	0.884	

In reliability test, 5 out of 6 variables have values more than 0.7 which are considered acceptable suggesting strong internal consistency reliability for the scale with this sample. The Cronbach's Alpha coefficients for every single variable are shown in table 6.3. The following sub-construct measurements (SUA5, PLC1 and HRC6) will be deleted from their sets to improve the Cronbach's Alpha coefficients level and then the improved variables to be used for later tests in this chapter. After re-running the test through SPSS, the Cronbach Alpha for each variable had values > 0.7.

6.6. Results from Correlation Analysis

A calculate variable was used based on the mean score of a number of items for each of the constructs in the model framework, as each construct was measured by several items in the questionnaire, which will be used in further analysis such as correlation and regression. Pearson r correlation was applied to indicate the relationship between independent variables and the dependent variables, as described in Table (6.4). Cohen (1988) recommends that the correlation coefficient value (r) with a range of 0.10 to 0.29 is considered weak, the range of 0.30 to 0.49 is considered medium and the range of 0.50 to 1.0 is considered strong.

From table 6.4, the strongest relationships are between HP Telemedicine Readiness and the following: HP HR Capability (r = 0.535 and $p < 0.001$), HP IT Infrastructure (r = 0.44 and $p < 0.001$), Service Users Acceptance (r = 0.33 and $p < 0.001$), HP User Acceptance (r = 0.321 and $p < 0.001$). HP Learning Capabilities (r = 0.28) has low relationship with HP Telemedicine Readiness. In terms of HP Operational Capability, the strongest relationships are with HP User Acceptance (r = 0.539 and $p < 0.001$), HP HR Capability (r = 0.427 and $p < 0.001$) and HP Learning Capability (r = 0.344 and $p < 0.001$). In regards to Telemedicine Outcome Expectations, the strongest relationships are with HP User Acceptance (r = 0.654 and $p < 0.001$) and HP HR Capability (r = 0.521 and $p < 0.001$). However, HP Learning Capabilities has weak relationship (r = 0.22 and $p = 0.005$) and HP IT Infrastructure has no significant relationship ($p = 0.066$) with Telemedicine Outcome Expectations. With regards to Telemedicine Adoption, the strongest relationships are with Telemedicine Outcome Expectations (r = 0.557 and $p < 0.001$), Telemedicine Readiness (r = 0.514 $p < 0.001$) and HP Operational Capability (r = 0.444 and $p < 0.001$).

Table 6.4: Pearson's correlations matrix

	Service User Acceptance	TM Access	HP User Acceptance	HP Learning Capability	HP Operational Capability	HP IT Infrastructure	HP HR Capability	TM Outcome Expectations	TM Readiness
Service User Acceptance	1								
TM Access	.276**	1							
HP User Acceptance	.562**	.293**	1						
HP Learning Capability	.150	.259**	.318**	1					
HP Operational Capability	.301**	.277**	.539**	.344**	1				
HP IT Infrastructure	.011	.244**	.076	.393**	.211**	1			
HP HR Capability	.448**	.245**	.502**	.197*	.427**	.186*	1		
TM Outcome Expectations	.512**	.264**	.654**	.220**	.442**	.145	.521**	1	
TM Readiness	.330**	.294**	.321**	.280**	.277**	.440**	.535**	.310**	1
TM Adoption	.543**	.252**	.534**	.201*	.444**	.216**	.614**	.557**	.514**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

6.7. Results from Factor Analysis

The factor analysis test is part of the construct validity process for the questionnaire as a measurement tool used for data collection in this research (Trochim, 2006). According to Bryman (2015), factor analysis is a statistical technique generally used through measurement development to cluster items or measurements into common components, interpret each component according to the items having a high loading on it, and summarise the items into a less number of measures. A component is a list of items or measurements that belong together and the related items or measurements define the part of the construct that can be grouped together (Parsian and Dunning, 2009). Unconnected items, those that do not define a construct should be deleted (Munro, 2005). All the above is important to validate the questions of the measurement developed and adopted to represent the underlying conceptual framework.

Exploratory Factor Analysis (EFA) is a specific technique used to define the relationships among variables (Bryman and Cramer, 2005). EFA provides researchers with assessment to examine the variables based on the conceptual framework by indicating the direction of the measure (DeVon et al., 2007). Moreover, this technique helps to decrease the measurement questions inventory by removing the less significant ones for increased accuracy (Field, 2013; Hair et al., 2010).

It is important to have an adequate sample size to allow factor analysis to be conducted (Bryman and Cramer, 2005). Although, the number of participants required when undertaking factor analysis test remain under debate, a minimum of five participants per variable is generally suggested (Munro, 2005). The questionnaire, currently under validation process, consists of 31 items (sub-construct measurements to predict the model outcomes), and if multiplied by 5 as recommended by Munro (2005), resulting in 155 required as an adequate sample size and that is below the collected sample size of 161 in this research.

However, to ensure further that an adequate sample size was obtained for this research to enable factor analysis to be conducted, two further conditions are considered: Kaiser-Meyer-Olkin (KMO) sampling adequacy and factor (component) loading (Parsian and Dunning, 2009).

From the results obtained in this research as shown in Table 6.5, KMO was 0.766 and the significance of Bartlett's statistic ($p < 0.001$). The KMO statistic varies between 0 and 1, and Kaiser (1974) suggested considering values ≥ 0.5 and defined values in the range of 0.5 to 0.7 as mediocre, the range of 0.7 to 0.8 as good and the range of 0.8 to 0.9 as great. Therefore, the sampling adequacy value of 0.766 for the questionnaire in this research is good according to Kaiser's scale.

Table 6.5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.776
Bartlett's Test of Sphericity	Approx. Chi-Square	3955.532
	df	703
	Sig.	**.001**

*. The mean difference is significant at the 0.05 level.

6.8. Principal Component Analysis

The most used type of extraction methods in EFA is the Principal Component Analysis (PCA) in which all variance (total variance) of a variable is analysed. Total variance consists of specific, which describes the specific variation of a variable, and common variance, which refers to the variance shared by the scores of subjects with the other variables (Bryman and Cramer, 2005). PCA is an adequate method for minimising the number of measures or items to a smaller number with a more meaningful structure (Hair et al., 2010).

According to Bryman and Cramer (2005), two conditions used to identify how many components (factors) should be retained. The first one is the Kaiser condition to select those components that have an eigenvalue ≥ 1.00. The second condition is the screen plot to depict the descending variance that accounts for the factors extracted in graph form. The factors that come before the point at eigenvalue start to descent can be retained and that is considered to be reasonable (Field, 2013). This achieves the minimum number of measures or questions or items to symbolize a more accurate measurement tool. Therefore, PCA is considered to be a reliable method and with less error (Bryman and Cramer, 2005) and thus, the PCA was adopted in the current research and used on the 31 questions or items.

On running PCA, 9 components had eigenvalues > 1.00 at a cumulative total variance of 71.64% as shown in Table 6.6.

Table 6.6: Total Variance Explained (n=161)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.595	24.556	24.556	8.595	24.556	24.556	4.049	11.568	11.568
2	4.017	11.478	36.034	4.017	11.478	36.034	3.676	10.504	22.072
3	2.749	7.854	43.889	2.749	7.854	43.889	3.521	10.061	32.134
4	2.433	6.952	50.840	2.433	6.952	50.840	2.617	7.476	39.609
5	1.975	5.643	56.484	1.975	5.643	56.484	2.577	7.362	46.972
6	1.717	4.906	61.390	1.717	4.906	61.390	2.293	6.551	53.523
7	1.459	4.169	65.559	1.459	4.169	65.559	2.267	6.476	59.999
8	1.244	3.554	69.113	1.244	3.554	69.113	2.111	6.032	66.031
9	1.108	3.167	72.280	1.108	3.167	72.280	1.963	5.610	**71.641 %**
10	.927	2.935	75.215						
11	.879	2.511	77.726						
12	.763	2.181	79.907						
13	.707	2.021	81.928						
14	.651	1.861	83.790						
15	.590	1.686	85.476						
16	.505	1.443	86.919						
17	.475	1.357	88.276						
18	.414	1.183	89.460						
19	.387	1.105	90.565						
20	.367	1.048	91.613						
21	.333	.952	92.565						
22	.318	.908	93.473						
23	.290	.830	94.303						
24	.240	.684	95.773						
25	.202	.577	96.969						
26	.187	.535	97.503						
27	.174	.496	98.000						
28	.137	.390	98.821						
29	.119	.341	99.163						
30	.108	.309	99.472						
31	.084	.241	**100 %**						

Extraction Method: Principal Component Analysis.

It is important to look at the Scree Plot to reduce the number of extracted components using Kaiser Criterion. The Scree Plot in the following figure 6.1, shows is a clear break after the ninth component. According to Stevens (2012), the eigenvalue and screen plot are accurate to define how many components (factors) should be retained when the questionnaire has more than 30 items and variance ≥ 70%. It has been decided to keep the first 9 components for further examination.

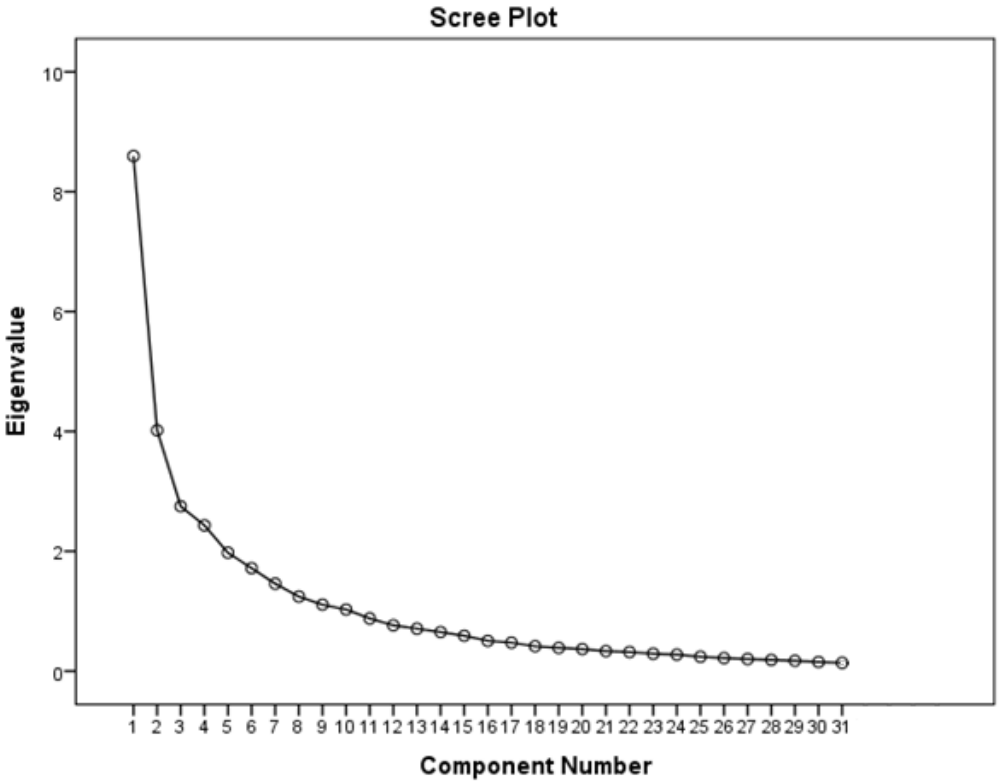


Figure 6.1: The Scree Plot

After factor extraction it might be hard to interpret and rename the components (factors) on the basis of their factor loadings because "*most variables have high loadings on the most important factor and small loadings on all other factors*" (Field, 2013). Therefore, interpretation of the components (factors) could be difficult and can be clarified through factor rotation.

Factor rotation could change the arrangement of the factor loadings for better clarification and the interpretation could be improved. Therefore, the 9 retained factors solution with Varimax rotation, the most commonly used orthogonal rotation (Field, 2013), are statistically and conceptually appropriate to the measurement used in this research for further data analysis and interpretations.

Table 6.7: Rotated Component Matrix

	Component							
	1	2	3	4	5	6	7	8
HP User Acceptance Q5	.767							
HP User Acceptance Q3	.753							
HP User Acceptance Q2	.747							
HP User Acceptance Q1	.726							
HP User Acceptance Q4	.633							
HP HR Capability Q4		.873						
HP HR Capability Q5		.835						
HP HR Capability Q1		.762						
HP HR Capability Q3		.730						
HP HR Capability Q2		.705						
HP IT Infrastructure Q4			.825					
HP IT Infrastructure Q5			.789					
HP IT Infrastructure Q3			.780					
HP IT Infrastructure Q1			.778					
HP IT Infrastructure Q2			.777					
HP Learning Capability Q5				.860				
HP Learning Capability Q4				.851				
HP Learning Capability Q3				.721				
TM Access Q2					.857			
TM Access Q3					.792			
TM Access Q1					.749			
TM Access Q5						.882		
TM Access Q6						.867		
TM Access Q4						.510		
HP User Acceptance Q6							.750	
HP User Acceptance Q7							.685	
Service User Acceptance Q4							.539	
Service User Acceptance Q1								.868
Service User Acceptance Q2								.794
Service User Acceptance Q3								.510

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table (6.7) shows the rotated component matrix with clustered factors on 8 components as one variable (LC2 did not load successfully), out of the 31 (remaining from reliability test) measures or items in the questionnaire, eliminated using Stevens (2012) guideline of statistical significance for interpreting factor loadings which suggests that the statistically adequate loading for 50 participants is 0.72, for 100 participants 0.51 and for 200-300 participants 0.29-.38. The sample size used in the current research is 161 and this one item loading was ≤ 0.50. Therefore, a decision was taken to delete this item resulting in a total of 30 items in the questionnaire (as a measurement tool to predict the model outcomes).

These 30 items can be multiplied by 5 resulting in a 150 sample size, and this is below the current study sample size of N=161. Therefore, the measurement (questionnaire) used in this research is considered accurate as the exploratory factor analysis was achieved. Furthermore, table (6.7) reveals that there is a division of importance between the remaining 8 rotated components. Gefen (2005) explained that "*technically, an EFA identifies the underlying latent variables, or factors, that explain the pattern of correlations within a set of measurement items. Once this data reduction identifies a small number of factors that explain most of the variance in the measurement items, the loading pattern of these measurement items is determined and revealed in the statistical output*".

In the current research, the main important factors loadings > 0.5 were identified in 8 sets of components and they are as follows:

- ***Component 1*** was: HP User Acceptance Q1 to Q5 and these measurements have the pattern of healthcare provider user acceptance for monitoring or following up the patients' management.
- ***Component 2*** main important loadings were: HP Human Resources Capability Q1 to Q5.
- ***Component 3*** was: IT Infrastructure Q1 to Q5.
- ***Component 4*** includes HP Learning Capability Q3, Q4 and Q5 and these are measuring the organisational capability of utilizing knowledge.
- ***Component 5*** includes Telemedicine Access Q1 to Q3 and these measures are related to the currently used technologies within healthcare institutions such as telephones and emails.
- ***Component 6*** includes Telemedicine Access Q4 to Q6 where the Telemedicine technologies such as video conferencing and Telemedicine software and hardware are not deployed yet in the Libyan healthcare system.
- ***Component 7*** consists of HP User Acceptance Q6, Q7 plus the Service User Acceptance Q4. In component 7, all the measures are related to the concept "Ease of Use" of Telemedicine technology to both healthcare providers and service users.
- ***Component 8*** includes the Service User Acceptance Q1 to Q3 and these are related to the diagnosis and treatment stages.

From the 8 mentioned grouping sets, the researcher suggested a change of the original 6 factors conceptual model into 8 factors conceptual framework with re-naming some of the factors as following:

1. Service User Acceptance "during consultation period" (Q1, Q2 and Q3).
2. Telemedicine Current Access (Q1, Q2 and Q3).
3. Telemedicine Potential Access (Q4, Q5 and Q6).

The above three factors are precursors in the conceptualised model.

4. Healthcare Provider User Expectations "during monitoring and follow-up period" (Q1, Q2, Q3, Q4 and Q5).
5. Telemedicine Ease of Use (HPUA Q6 and Q7 plus SUA Q4).
6. Healthcare Provider Human Resources Capability (Q1, Q2, Q3, Q4 and Q5).
7. Healthcare Provider IT Infrastructure (Q1, Q2, Q3, Q4 and Q5).
8. Healthcare Provider Learning Capability (Q3, Q4 and Q5).

In conclusion of this part of the result, 30 of the questionnaire items loaded successfully (loading > 0.5) on related and defined factors. This indicated that the SPSS software grouped the questions in an order that reflected the hypothesised factors in the conceptual framework model with new latent variables, which were not directly observed or theorised but rather emerged through EFA from other theorised variables.

A repeated Cronbach Alpha reliability test is re-run again on all extracted measures to check the internal consistency of the factors. The results showed higher internal consistency as shown in Table 6.8.

Table 6.8: Cronbach Alpha Reliability Test for the Revised Measures

Model Constructs	**Cronbach Alpha (α)**	**Cronbach Alpha (α) Revised**
Service User Acceptance	0.704	0.766
Telemedicine Current Access	0.781	0.814
Telemedicine Potential Access		0.793
HP User Expectations	0.877	0.872
Telemedicine Ease of Use		0.786
HP Learning Capability	0.777	0.839
HP IT Infrastructure	0.866	0.866
HP HR Capability	0.884	0.884

Subsequently, the measurement model resulting from both reliability and exploratory factor analysis is accomplished. The next step is revising the conceptual framework, drafting out the emerging factors and then calculating the score of each factor variable by taking the mean of its measures. This step is important in order for the regression analysis to be conducted.

6.9. Regression Analysis for Model Testing

A multiple linear regression analysis is conducted to investigate the relationships between independent variables and a dependent variable (Hair et al., 2010; Pallant, 2011). This technique is chosen because there is a set of independent variables adopted to predict a single dependent variable as suggested by Pallant (2011).

Additionally, regression analysis was performed to test the hypotheses suggested in chapter 3. Figure 6.2 which shows the revised conceptual framework model of this research and is divided into four stages. Every stage deals with part of the framework model and this is important to help understand and define the existence of independent and dependent variables in each stage of the regression process.

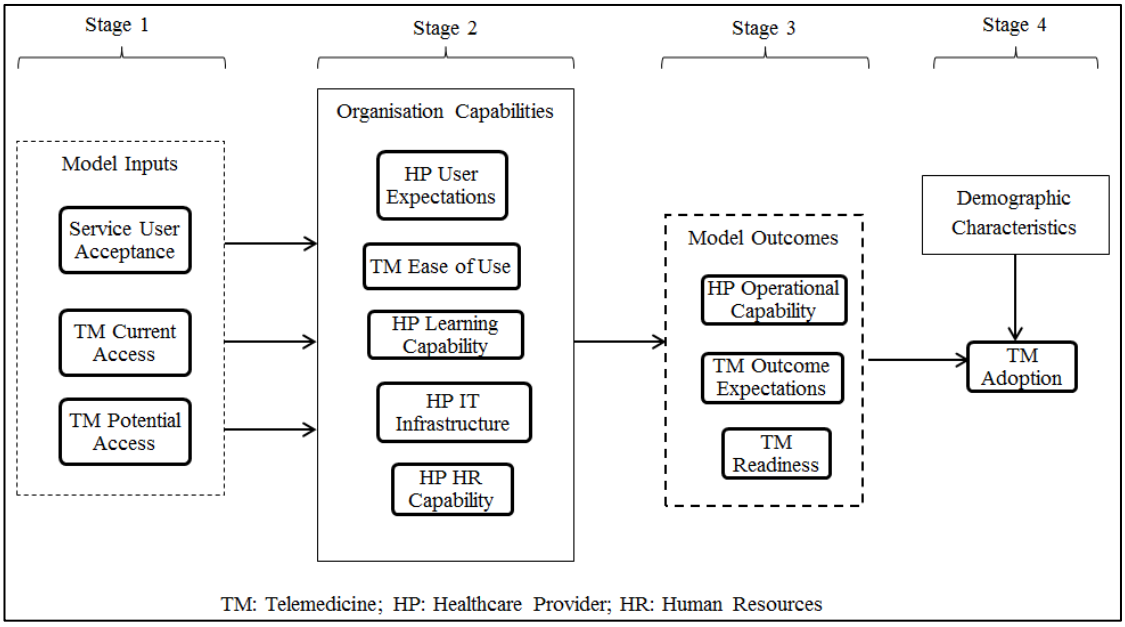


Figure 6.2: Revised Conceptual Model Based on Factor Analysis

6.9.1 The first part of the multiple regression - Model 1 (Stage 1 to 2)

In this part of the analysis we focus on the impact of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access as independent variables on organisation capabilities (HP User Expectations, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability each as dependent variable). The first part of the regression is shown in Figure 6.3.

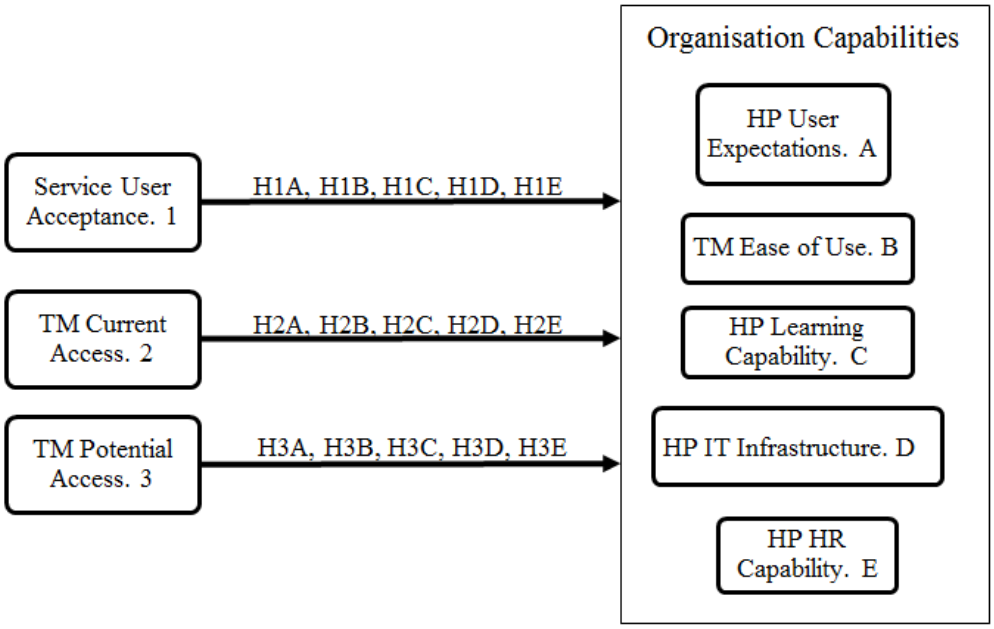


Figure 6.3: Model 1 hypotheses related to Service User Acceptance and Telemedicine Current and Potential Access

Model 1: Hypotheses

H1A. Service User Acceptance positively influences HP User Expectations.

H1B. Service User Acceptance positively influences Telemedicine Ease of Use.

H1C. Service User Acceptance positively influences HP Learning Capability.

H1D. Service User Acceptance positively influences HP IT Infrastructure.

H1E. Service User Acceptance positively influences HP HR Capability.

H2A. Telemedicine Current Access positively influences HP User Expectations.

H2B. Telemedicine Current Access positively influences Telemedicine Ease of Use.

H2C. Telemedicine Current Access positively influences HP Learning Capability.

H2D. Telemedicine Current Access positively influences HP IT Infrastructure.

H2E. Telemedicine Current Access positively influences HP HR Capability.

H3A. Telemedicine Potential Access positively influences HP User Expectations.

H3B. Telemedicine Potential Access positively influences Telemedicine Ease of Use.

H3C. Telemedicine Potential Access positively influences HP Learning Capability.

H3D. Telemedicine Potential Access positively influences HP IT Infrastructure.

H3E. Telemedicine Potential Access positively influences HP HR Capability.

The effects of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access on Organisation Capabilities are tested using multiple regression analysis. Five steps of multiple regression analysis are presented in Tables (6.9 - 6.13) as the variables set of (Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access) are independent variables, while each construct in Organisation Capabilities is a dependent variable.

Step 1: Tests on the effects of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access on HP User Expectations

The results from Table 6.9 show that Service User Acceptance and Telemedicine Potential Access both have significant relationships with HP User Expectations, thus supporting H1A and H3A. From the results, Service User Acceptance and Telemedicine Potential Access make a beneficial contribution to HP User Expectations. The Beta value, in table 6.8, is an indication of how much impact each independent (predictor) variable has on the dependent variable. That means the higher the Beta value of the independent variable is, the greater the impact would be on the dependant variable (Pallant, 2011). Hence, Service User Acceptance makes the strongest impact on HP User Expectations as Beta value is 0.322 followed by Telemedicine Potential Access as Beta = 0.281. (Model: R = 0.434, R^2 = 0.188 and $p < 0.001$).

Table 6.9: Multiple regression analysis - HP User Expectations

a. Dependent Variable: HP User expectations.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Service User Acceptance	.215	.050	**.322**	4.334	**.001***
Telemedicine Current Access	-.015	.059	-.020	-.261	.795
Telemedicine Potential Access	.232	.063	**.281**	3.685	**.001***

*. The mean difference is significant at the 0.05 level.

Step 2: Tests on the effects of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access on Telemedicine Ease of Use

Table 6.10 shows that Service User Acceptance and Telemedicine Potential Access both have significant impact with Telemedicine Ease of Use, thus supporting H1B and H3B. From the results, Service User Acceptance and Telemedicine Potential Access make a beneficial contribution to HP User Expectations. Service User Acceptance makes the strongest influence on HP User Expectations where Beta value is 0.35 followed by Telemedicine Potential Access as Beta = 0.242. (Model: R = 0.444, R^2 = 0.182 and $p < 0.001$).

Table 6.10: Multiple regression analysis - Telemedicine Ease of Use

a. Dependent Variable: Telemedicine Ease of Use

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Service User Acceptance	.299	.063	**.350**	4.737	**.001***
Telemedicine Current Access	.013	.075	.013	.170	.865
Telemedicine Potential Access	.256	.080	**.242**	3.191	**.002***

*. The mean difference is significant at the 0.05 level.

Step 3: Tests on the effects of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access on HP Learning Capability

The results from Table 6.11 show that Telemedicine Potential Access has a significant impact on HP Learning Capability supporting H3C. However, Service User Acceptance and Telemedicine Current Access both have no significant relationships with HP Learning Capability, thus not supporting H1C and H2C. (Model: R = 0.216, R^2 = 0.047 and $p < 0.05$).

Table 6.11: Multiple regression analysis - HP Learning Capability

a. Dependent Variable: HP Learning Capability

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Service User Acceptance	-.017	.058	-.024	-.296	.768
Telemedicine Current Access	.085	.069	.104	1.223	.223
Telemedicine Potential Access	.144	.074	**.161**	1.957	**.049***

*. The mean difference is significant at the 0.05 level.

Step 4: Tests on the effects of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access on HP IT Infrastructure

Table 6.12 suggests that Telemedicine Current Access (technologies are currently available such as internet and emails) has a significant relationship with HP IT Infrastructure, however Service User Acceptance and Telemedicine Potential Access (technologies are not easily available and affordable yet such as video conferencing) have no significant relationships with HP IT Infrastructure, thus supporting H2E and not supporting H1E and H3E. From the results, only Telemedicine Current Access makes a significant contribution to HP IT Infrastructure with Beta value of 0.194. (Model: R = 0.248, R^2 = 0.061 and p = 0.019). The Telemedicine Current Access of healthcare systems is highly dependent on HP IT Infrastructure of organisations. Therefore, in order to increase the access to healthcare systems by utilising Telemedicine, it is important for health care organisations to have a capable IT infrastructure.

Table 6.12: Multiple regression analysis - HP IT Infrastructure

a. Dependent Variable: IT Infrastructure

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Service User Acceptance	-.011	.074	-.012	-.149	.882
Telemedicine Current Access	.203	.089	**.194**	2.291	**.023***
Telemedicine Potential Access	.123	.095	.107	1.306	.194

*. The mean difference is significant at the 0.05 level.

Step 5: Tests on the effects of Service User Acceptance, Telemedicine Current Access and Telemedicine Potential Access on HP HR Capability

Table 6.13 suggests that Service User Acceptance and Telemedicine Current Access both have a significant influence on HP HR Capability, which confirms H1F and H2F. Telemedicine Potential Access has no significant relationships with HP HR Capability, thus not supporting H3F.The highest absolute value of beta comes from Telemedicine Current Access, with beta=0.230 and then Service User Acceptance with Beta value of 0.208. This means that Telemedicine Current Access makes the strongest contribution to HP HR Capability. (Model: R = 0.349, R^2 = 0.122 and $p < 0.001$).

Table 6.13: Multiple regression analysis - HP HR Capability

a. Dependent Variable: HP Human Resources Capability

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Service User Acceptance	.171	.064	**.208**	2.685	**.008***
Telemedicine Current Access	.214	.076	**.230**	2.813	**.006***
Telemedicine Potential Access	.009	.081	.008	.107	.915

*. The mean difference is significant at the 0.05 level.

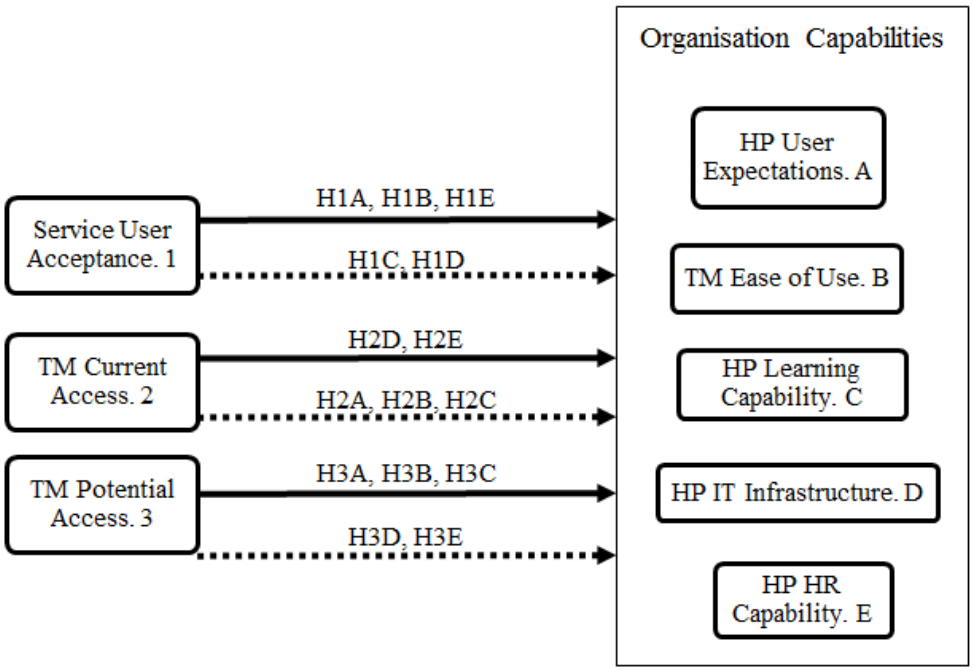


Figure 6.4: Model 1 Revised hypotheses based on regression analysis
Dash lines indicate non-significant effect, solid lines indicate significant effect

6.9.2 The second part of the multiple regressions Model 2 (Stage 2 to 3)

In this part of the analysis we examine the influence of the organisation capabilities (HP User Expectations, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability) on HP Operational Capability. This part of the framework model is shown in Figure 6.5.

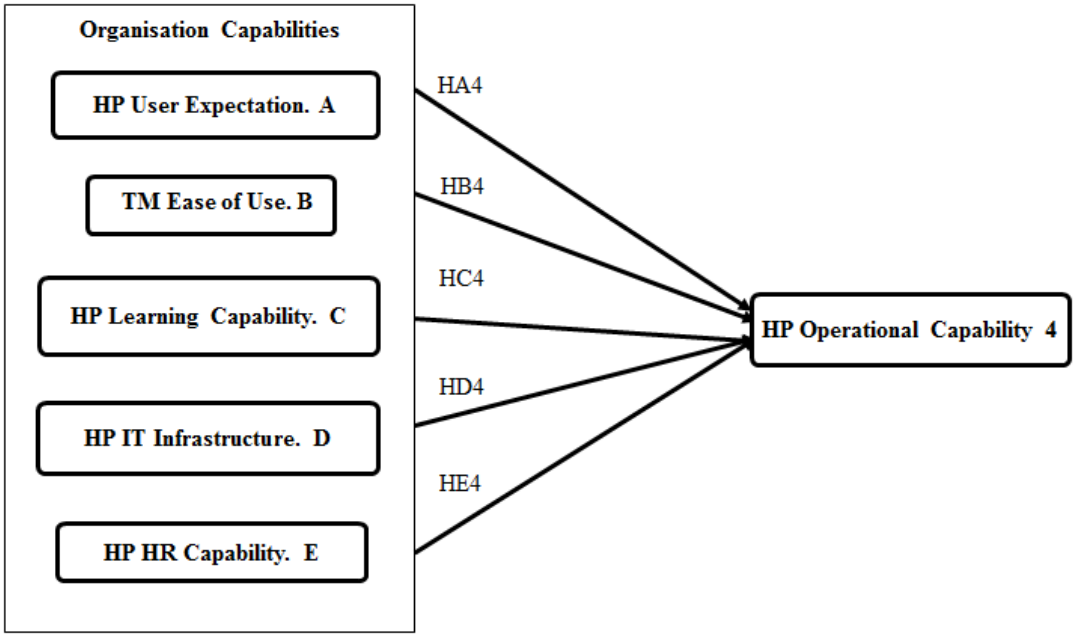


Figure 6.5: Model 2 hypotheses related to organisation capabilities on HP Operational Capability

Model 2: Hypotheses

HA4. HP User Expectations positively influence Telemedicine Operational Capability.

HB4. Telemedicine Ease of Use positively influences Telemedicine Operational Capability.

HC4. HP Learning Capability positively influences Telemedicine Operational Capability.

HD4.HP IT Infrastructure positively influences Telemedicine Operational Capability.

HE4. HP HR Capability positively influences Telemedicine Operational Capability.

Those hypotheses are tested using regression analysis. Each construct of the five organisational capabilities was the independent variable, while the Telemedicine Operational Capability was the dependent variable.

Table 6.14 suggests that HP User Expectations, Telemedicine Ease of Use, HP Learning Capability and HP IT Infrastructure have significant influences on Telemedicine Operational Capability, which confirms HA4, HB4, HC4 and HD4. On the other hand, HP HR Capability does not have a significant influence on the Telemedicine Operational Capability, which rejects HE4 hypothesis. The highest absolute value of beta comes from HP User Expectations, with beta = 0.314. This means that HP User Expectations make the strongest contribution to the Telemedicine Operational Capability.

Table 6.14: Multiple regression analysis – Telemedicine Operational Capability

a. Dependent Variable: HP Operational Capability

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
HP User Expectations	.321	.090	**.314**	3.569	**.001***
Ease of Use	.139	.064	**.174**	2.178	**.031***
HP Learning Capability	.144	.068	**.152**	2.116	**.036***
HP IT Infrastructure	.097	.051	**.133**	1.903	**.049***
HP HR Capability	.089	.062	.107	1.427	.156

*. The mean difference is significant at the 0.05 level.

From Table 6.15, R^2 suggests that the independent variables (HP User Expectations, Telemedicine Ease of Use, HP Learning Capability, IT Infrastructure and HP HR Capability) are responsible for about 35.3% of the variance in the Telemedicine Operational Capability.

Table 6.15: Model 3 Summary

Model	R	R Square	Std. Error of the Estimate	Change Statistics		
				R Square	F	Sig.
1	.594[a]	.353	.52817	.353	16.926	**.001***

a. Predictors: (Constant), HP Learning Capability, Ease of Use, HP IT Infrastructure, HP HR Capability, HP User Expectations

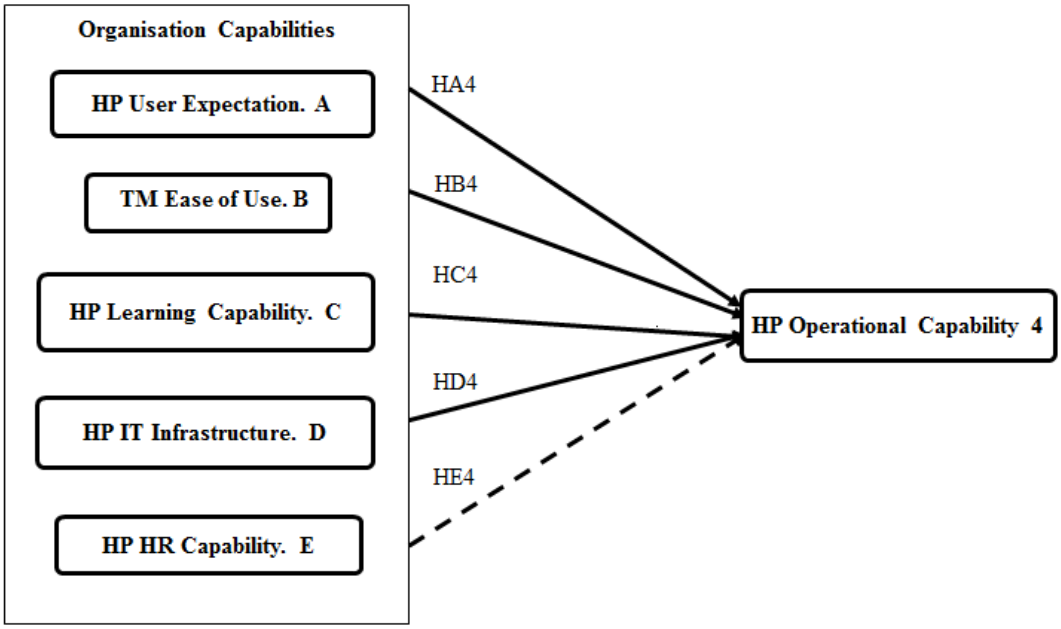


Figure 6.6: Model 2 revised hypotheses based on regression analysis
Dash lines indicate non-significant effect, solid lines indicate significant effect

6.9.3 The third part of the multiple regressions Model 3 (Stage 2 to 3)

In this part of the analysis we examine the influence of the organisation capabilities (HP User Expectations, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability) on Telemedicine Outcome Expectations. This part of the research model is shown in Figure 6.7.

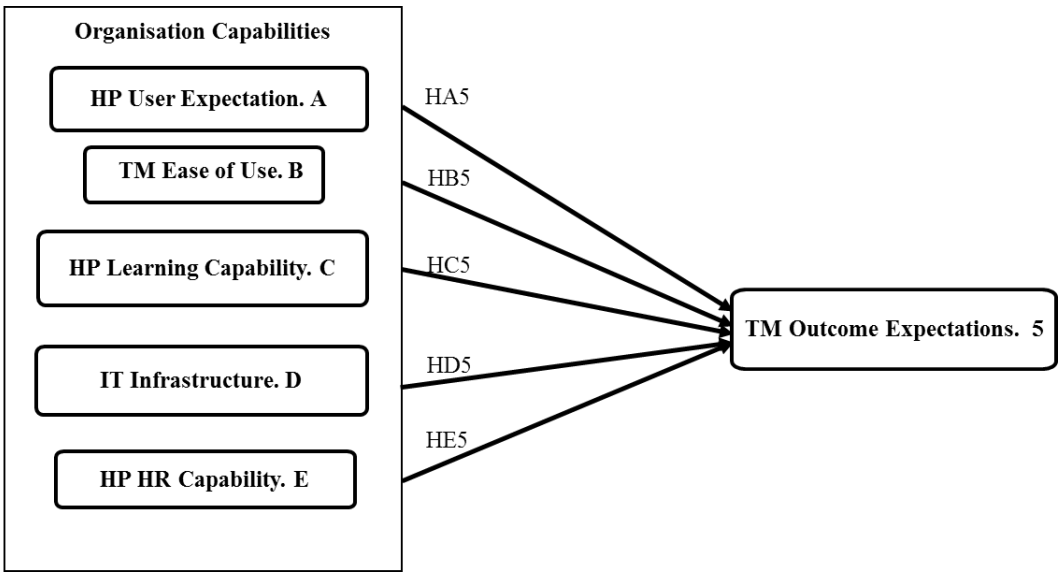


Figure 6.7: Model 3 hypotheses related to organisation capabilities on Telemedicine Outcome Expectations

Model 3: Hypotheses

HA5. HP User Expectations positively influence the Telemedicine Outcome Expectations.

HB5. Telemedicine Ease of Use positively influences the Telemedicine Outcome Expectations.

HC5. HP Learning Capability positively influences the Telemedicine Outcome Expectations.

HD5. HP IT Infrastructure positively influences the Telemedicine Outcome Expectations.

HE5. HP HR Capability positively influences the Telemedicine Outcome Expectations.

Those hypotheses are tested using regression analysis. Each construct of the organisation capabilities was an independent variable, while the Telemedicine Outcome Expectations was the dependent variable.

Table 6.16 suggests that HP User Expectations and HP HR Capability have significant influences on Telemedicine Outcome Expectations, which confirms HA5 and HE5. On the other hand, Telemedicine Ease of Use, HP Learning Capability, and HP IT Infrastructure do not have a significant influence on the Telemedicine Outcome Expectations, which not supporting HB5, HC5 and HD5 hypotheses. The highest absolute value of beta comes from HP User Expectations, with beta = 0.506. This means that HP User Expectations makes the strongest contribution to the Telemedicine Outcome Expectations.

Table 6.16: Multiple regression analysis – Telemedicine Outcome Expectations

a. Dependent Variable: Telemedicine Outcome Expectation

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
HP User Expectations	**.569**	**.089**	**.506**	**6.412**	**.001***
Telemedicine Ease of Use	.073	.061	.083	1.189	.236
HP Learning Capability	-.023	.066	-.022	-.356	.722
HP IT Infrastructure	.068	.049	.085	1.393	.165
HP HR Capability	**.184**	**.059**	**.202**	**3.092**	**.002***

*. The mean difference is significant at the 0.05 level.

From Table 6.17, R^2 suggests that the independent variables (HP User Acceptance, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability) are responsible for about 52.2% of the variance in the Telemedicine Outcome Expectations.

Table 6.17: Model 3 Summary

Model	R	R Square	Std. Error of the Estimate	Statistics		
				F	df	Sig.
1	**.722[a]**	**.522**	.50112	28.028	6	**.001**

a. Predictors: (Constant), HP Operational Capability, HP IT Infrastructure, HP Human Resources Capability, HP Learning Capability, Telemedicine Ease of Use, HP User Expectations.

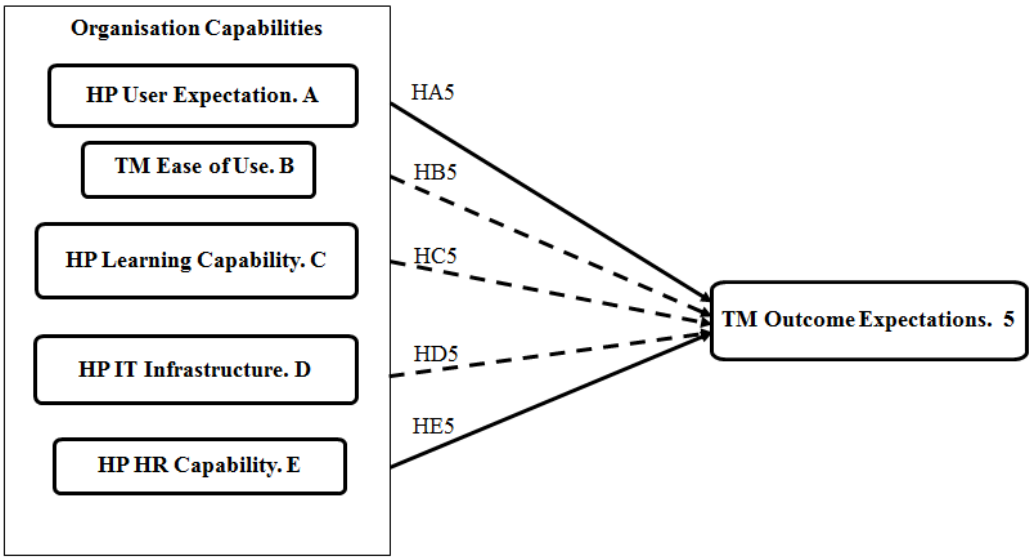


Figure 6.8: Model 3 Revised hypotheses based on regression analysis.
Dash lines indicate non-significant effect, solid lines indicate significant effect

6.9.4. The fourth part of the multiple regression Model 4 (Stage 2 to 3)

In this part of the analysis we examine the influence of the organisation capabilities (HP User Expectations, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability) on Telemedicine Readiness. This part of the research model is shown in Figure 6.9.

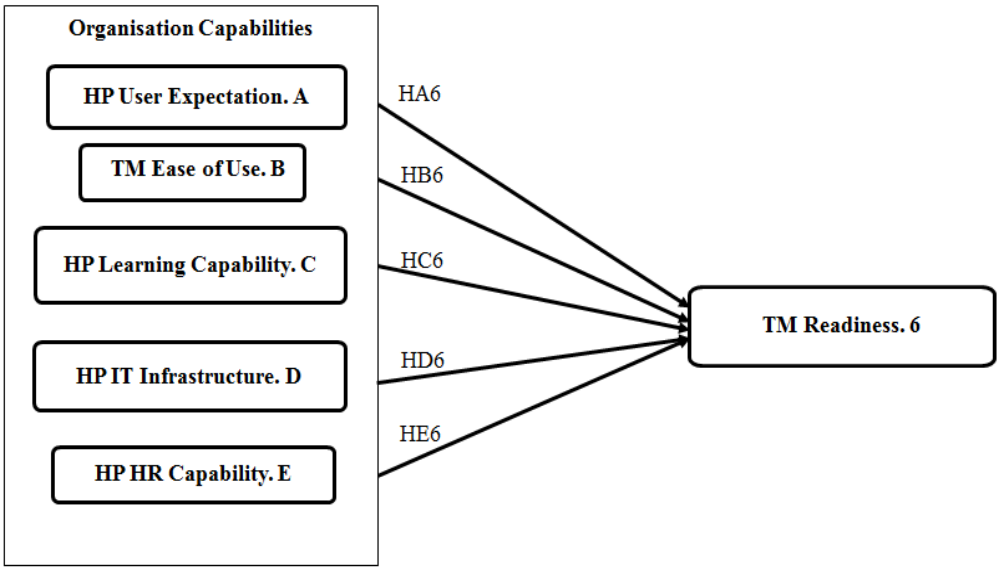


Figure 6.9: Model 4 Hypotheses related to organisation capabilities on Telemedicine Readiness

Model 4: Hypotheses

HA6. HP User Expectations positively influence Telemedicine Readiness.
HB6. Telemedicine Ease of Use positively influences Telemedicine Readiness.
HC6. HP Learning Capability positively influences Telemedicine Readiness.
HD6. HP IT Infrastructure positively influences Telemedicine Readiness.
HE6. HP HR Capability positively influences Telemedicine Readiness.

Those hypotheses are tested using multiple regression analysis. Each construct of the organisation capabilities was an independent variable, while Telemedicine Readiness was the dependent variable.

Table 6.18 suggests that Telemedicine Ease of Use, HP IT Infrastructure and HP HR Capability have significant influences on Telemedicine Readiness, which confirms HB6, HD6 and HE6. On the other hand, HP User Expectations and HP Learning Capability do not have a significant influence on the Telemedicine Readiness, which does not support HA6 and HC6 hypotheses. The highest absolute value of beta comes from HP HR Capability, with beta = 0.411. This means that HP HR Capability makes the strongest contribution to Telemedicine Readiness.

Table 6.18: Multiple regression analysis – Telemedicine Readiness

a. Dependent Variable: Telemedicine Readiness

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
HP User Expectations	-.018	.080	-.019	-.225	.823
Telemedicine Ease of Use	**.199**	**.055**	**.265**	**3.598**	**.001***
HP Learning Capability	-.022	.059	-.025	-.371	.711
HP IT Infrastructure	**.258**	**.044**	**.373**	**5.833**	**.001***
HP HR Capability	**.321**	**.054**	**.411**	**6.000**	**.001***

*. The mean difference is significant at the 0.05 level.

Table 6.19, R^2 suggests that the independent variables (HP User Acceptance, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability) are responsible for about 47.2% of the variance in Telemedicine Readiness.

Table 6.19: Model 4 Summary

Model	R	R Square	Std. Error of the Estimate	Change Statistics		
				F	df	Sig.
1	**.687[a]**	**.472**	.45154	22.983	6	**.000**

a. Predictors: (Constant), HP Operational Capability, HP IT Infrastructure, HP Human Resources Capability, HP Learning Capability, Telemedicine Ease of Use, HP User Expectations.

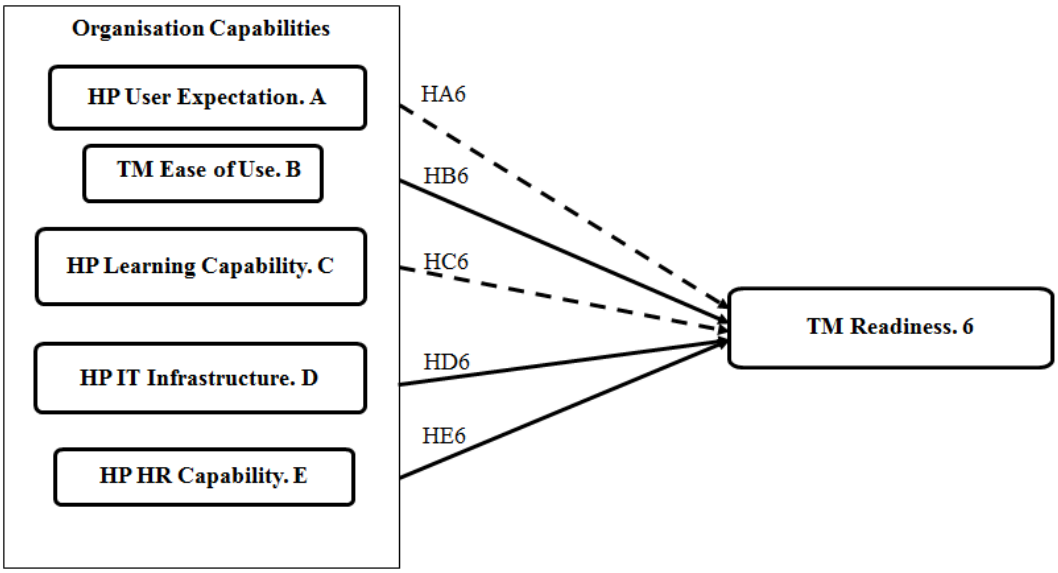


Figure 6.10: Model 4 Revised hypotheses based on regression analysis.
Dash lines indicate non-significant effect, solid lines indicate significant effect

6.9.5. The fifth part of the multiple regression Model 5 (Stage 3 to 4)

In this part of the analysis we examine the influence of the HP Operational Capability, Telemedicine Outcome Expectations and Telemedicine Readiness on Telemedicine Adoption. This part of the research model is shown in Figure 6.11.

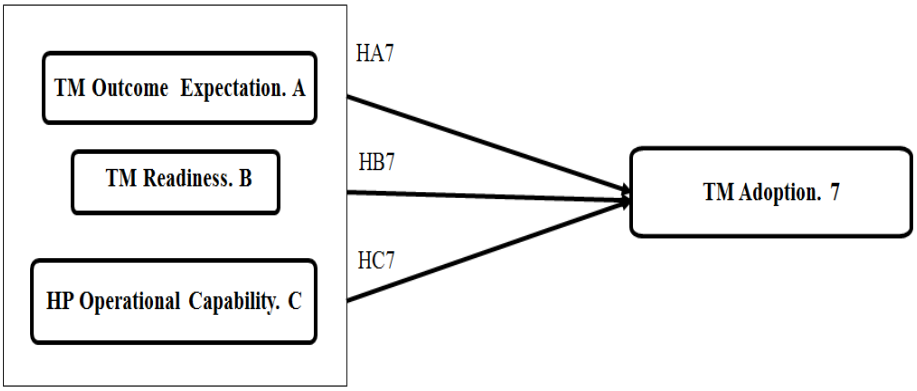


Figure 6.11: Model 5 Hypotheses related to HP Operational Capability, Telemedicine Outcome Expectations and Telemedicine Readiness on Telemedicine Adoption

Model 5: Hypotheses

HA7. HP Operational Capability positively influences Telemedicine Adoption.
HB7. Telemedicine Outcome Expectations positively influence Telemedicine Adoption.
HC7. Telemedicine Readiness positively influences Telemedicine Adoption.

Those hypotheses are tested using multiple regression analysis. Each construct of the HP Operational Capability, Telemedicine Outcome Expectations and Telemedicine Readiness was the independent variable, while Telemedicine Adoption was the dependent variable.

Table 6.20 suggests that HP Operational Capability, Telemedicine Outcome Expectations and Telemedicine Readiness have significant influences on Telemedicine Adoption, which confirms hypotheses HA7, HB7 and HC7. The highest absolute value of beta comes from Telemedicine Readiness, with beta = 0.402. This means that Telemedicine Readiness makes the strongest contribution to Telemedicine Adoption.

Table 6.20: Multiple regression analysis – Telemedicine Adoption

a. Dependent Variable: Telemedicine Adoption

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
HP Operational Capability	.118	.064	**.120**	1.836	**.048***
Telemedicine Outcome Expectations	.330	.060	**.367**	5.508	**.001***
Telemedicine Readiness	.421	.065	**.402**	6.476	**.001***

*. The mean difference is significant at the 0.05 level.

Table 6.21, R^2 suggests that the independent variables (HP Operational Capability, Telemedicine Outcome Expectations and Telemedicine Readiness) are responsible for 47.7% of the variance in Telemedicine Adoption.

Table 6.21: Model 5 Summary

Model	R	R Square	Std. Error of the Estimate	Change Statistics	
				F	Sig.
1	.691[a]	.477	.46635	47.726	.000

a. Predictors: (Constant), Telemedicine Readiness, HP Operational Capability, Telemedicine Outcome Expectation

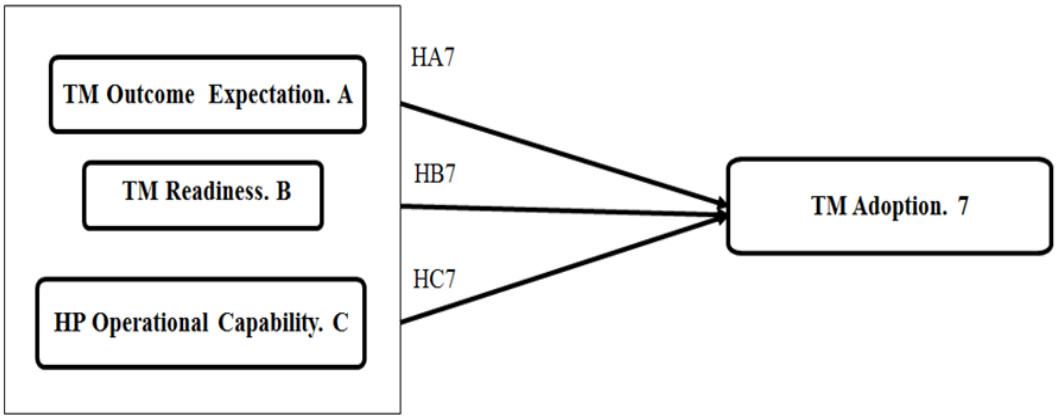


Figure 6.12: Model 5 Revised hypotheses based on regression analysis.
Solid lines indicate significant effect.

After completing the last part of the regression analysis, all the research hypotheses have been examined. Table (6.21) summarises the results of the multiple linear regression and indicates the supported and not supported hypotheses.

Table 6.22: Summary of accepted and not supported hypotheses as a result of regression analysis

Hypothesis	***Independent variable***	***Dependent variable***	***Results***
H1A	Service User Acceptance	HP User Expectations	Accepted
H1B		Telemedicine Ease of Use	Accepted
H1C		HP Learning Capability	Not supported
H1D		HP IT Infrastructure	Not supported
H1E		HP HR Capability	Accepted
H2A	Telemedicine Current Access	HP User Expectations	Not supported
H2B		Telemedicine Ease of Use	Not supported
H2C		HP Learning Capability	Not supported
H2D		HP IT Infrastructure	Accepted
H2E		HP HR Capability	Accepted
H3A	Telemedicine Potential Access	HP User Expectations	Accepted
H3B		Telemedicine Ease of Use	Accepted
H3C		HP Learning Capability	Accepted
H3D		HP IT Infrastructure	Not supported
H3E		HP HR Capability	Not supported
HA4	HP User Expectations	HP Operational Capability	Accepted
HB4	Telemedicine Ease of Use		Accepted
HC4	HP Learning Capability		Accepted
HD4	HP IT Infrastructure		Accepted
HE4	HP HR Capability		Not supported
HA5	HP User Expectations	Telemedicine Outcome Expectations	Accepted
HB5	Telemedicine Ease of Use		Not supported
HC5	HP Learning Capability		Not supported
HD5	HP IT Infrastructure		Not supported
HE5	HP HR Capability		Accepted
HA6	HP User Expectations	Telemedicine Readiness	Not supported
HB6	Telemedicine Ease of Use		Accepted
HC6	HP Learning Capability		Not supported
HD6	HP IT Infrastructure		Accepted
HE6	HP HR Capability		Accepted
HA7	HP Operational Capability	Telemedicine Adoption	Accepted
HB7	Telemedicine Outcome Expectations		Accepted
HC7	Telemedicine Readiness		Accepted

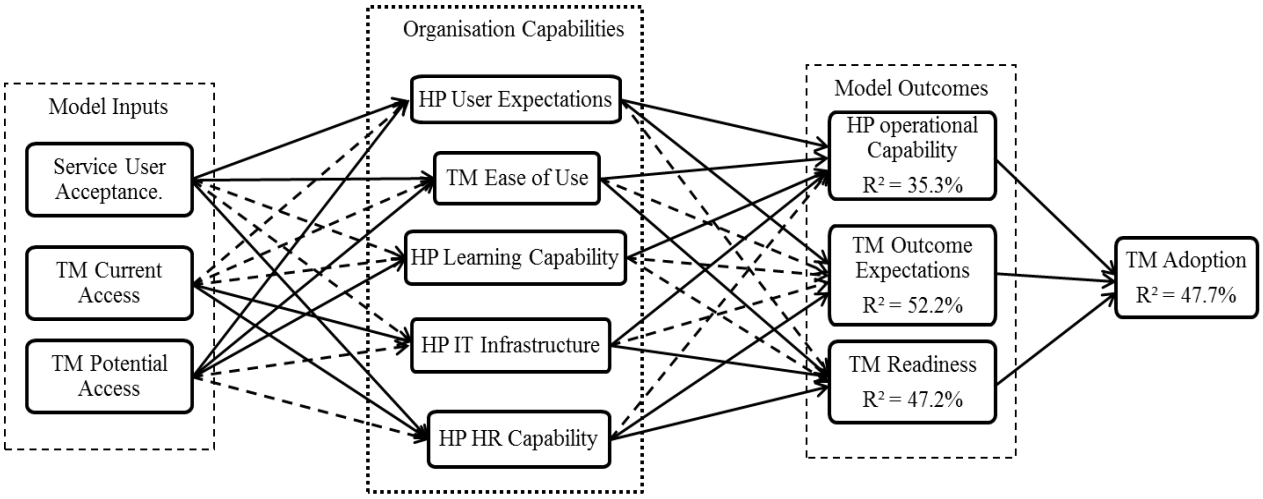
Result findings are in alignment with the work of Wisdom et al. (2014) in which they introduced the theoretical model of the Context-Mechanism-Outcome where each of these phases has different levels.

The Contexts have four levels: External Systems, Organisation, Innovation and Individual. The Mechanisms which have five levels with their constructs are: Changes in External System-Level Constructs (e.g. social network), Changes in Organisation-Level Constructs (e.g. readiness for change), Changes in Innovation-Level Constructs (e.g. innovation fit with users), Changes in Staff-Level Constructs (e.g. attitudes) and Changes in Client-Level Constructs (e.g. readiness for change). All these five levels are linked to two levels in Outcomes phase: Improved Pre-adoption and Improved Adoption.

Wisdom et al. (2014) said that existing adoption framework in the implementation and diffusion literature focused most heavily on the implementation stage of the process and less on the investigation stages such as readiness (also known as pre-implementation) or the sustainability stage (also known as post-implementation).

6.10. Revised Research Framework Model

The revised model as shown in Figure 6.13 is based on the results of regression analysis performed in the study. The original model's aim is to study different factors that have an effect on Organisation Capabilities as well as HP Operational Capability, Telemedicine Outcome Expectation, Telemedicine Readiness and Telemedicine Adoption. The revised model consists of different factors that have been found to have a significant effect and they include HP User Expectations, Telemedicine Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability. These organisational factors account for 35.3% variance of HP Operational Capability, 52.2% variance of the Telemedicine Outcome Expectations, 47.2% variance of Telemedicine Readiness and these last three outcome factors can explain 47.7% variance of Telemedicine Adoption. These good explanatory powers are higher than the TAM's explanatory power (R^2 = 35 - 40%).



TM: telemedicine; HP: healthcare provider; HR: human resources.

Figure 6.13: Revised Conceptual Model Based on Regression Analysis
Dash lines indicate non-significant effect, solid lines indicate significant effect

Chapter Seven: Discussion

Globally, chronic diseases are a major public health problem according to Gersh et al. (2010). In 2008, more than 1.2 million people in the Middle East and North African regions died from non-communicable diseases, accounting for nearly 60% of all deaths (Abdul-Rahim et al., 2014). The health status in Libya has changed from a high prevalence of infectious diseases and significant mortalities, to one where morbidity and mortality is more often linked to non-communicable chronic disease (WHO, 2007). Resources constraint is a major issue in designing and managing healthcare services in developing and industrialised nations alike (El-Taguri et al., 2008). Nevertheless, the healthcare systems in developing countries are confronted with further challenges and barriers such as infrastructure, technology and organisational issues (Paim et al., 2011).

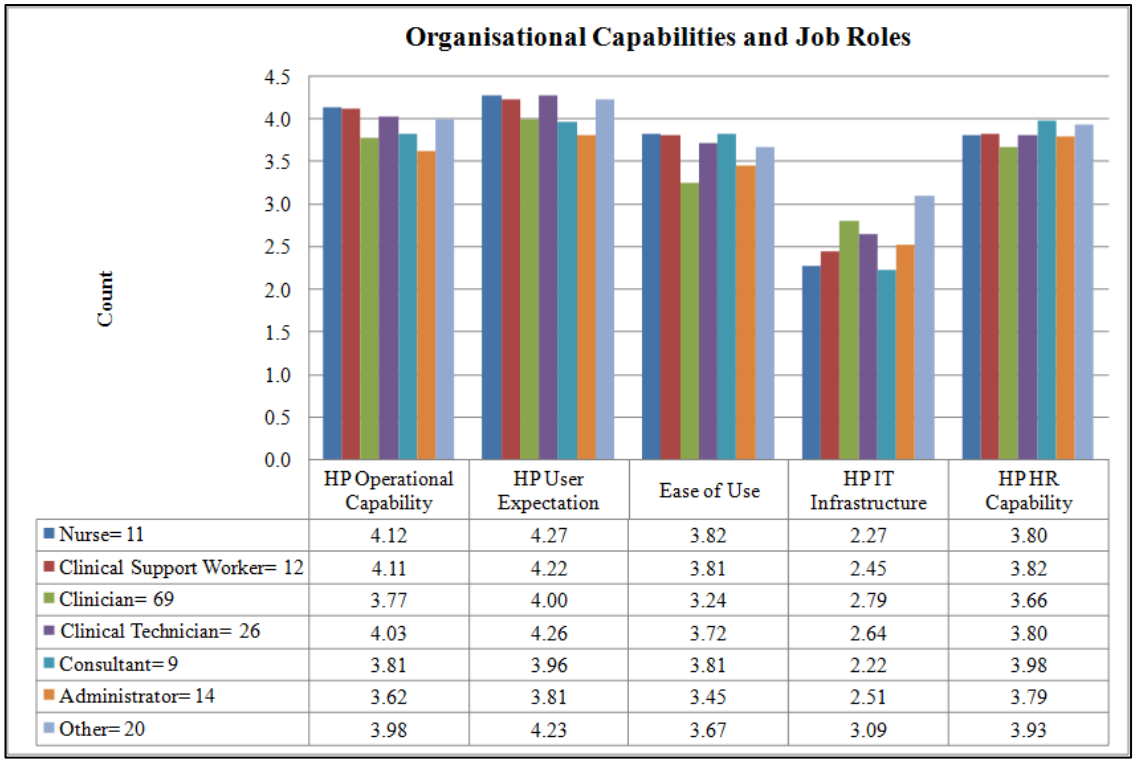
One of e-Health and Telemedicine applications is tele-monitoring of chronic diseases which appears to be a promising patient management approach and potentially may improve their medical conditions (Paré, et al., 2007). The focus of this study is to assess Telemedicine Readiness at an organisational level in Libya to adopt and utilise e-Health and Telemedicine technologies in order to improve the healthcare service provision as a value creation dimension for monitoring chronic conditions based on patient-centred healthcare system, regardless of where they are in the country's large surface area.
Findings and the potential outcomes of this study survey for Telemedicine Readiness and Telemedicine Adoption in Libya will be discussed in the current chapter.

7.1. Organisational Capabilities

E-Health and Telemedicine solutions may enrich organisations' immediate area of operations in healthcare industry where associated with service design. From a technical perspective, rapid and fundamental transformation of the healthcare sector through informatics is achievable. However, without a clear understanding of, and ability to manage organisational factors, it is unlikely that informatics applications will realise their potential in the health sector (Brear, 2006).

Contradictory to this, Thakur, Hsu and Fontenot (2012) stated that the structure of the healthcare organisation and lack of resources is the major barrier for implementing the technologies. Many of the healthcare organisations do not have adequate resources which they can use for implementing the technology efficiently. In contrast to this, Page (2014) stated that the there are many and different stakeholders that are involved within the healthcare industry and all these stakeholders have different agendas which work as the major barrier for implementing the technologies. This has been highlighted by Dr Fatima Hamroush (former Libyan Health Ministry) when a face-to-face interview was conducted during the pilot study stage at the conference organised by the Libyan Embassy in London in June 2014, where she said that some parties are not in support of implementing eHealth systems and Telemedicine technologies as it will minimise corruption within the Libyan healthcare system (Libya Higher Education Forum, 2014).

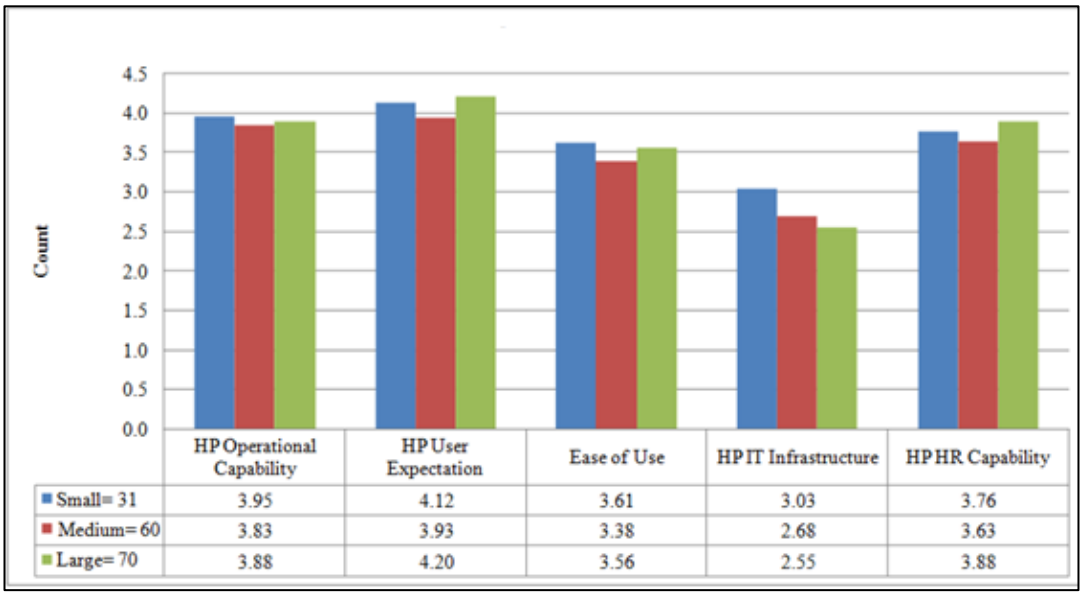
Cresswell and Sheikh (2013) stated that organisational concerns for technology implementations surrounding healthcare are critically important, however they have received adequate investigation. This might be in part because of the subjective sort of factors involved in the process, but also due to a lack of joint efforts in the direction of more theoretically and well-informed studies.



	HP Operational Capability	HP User Expectation	Ease of Use	HP IT Infrastructure	HP HR Capability
Nurse= 11	4.12	4.27	3.82	2.27	3.80
Clinical Support Worker= 12	4.11	4.22	3.81	2.45	3.82
Clinician= 69	3.77	4.00	3.24	2.79	3.66
Clinical Technician= 26	4.03	4.26	3.72	2.64	3.80
Consultant= 9	3.81	3.96	3.81	2.22	3.98
Administrator= 14	3.62	3.81	3.45	2.51	3.79
Other= 20	3.98	4.23	3.67	3.09	3.93

Figure 7.1: Organisational Capabilities with Healthcare Providers' Job Roles

Figure 7.1 above shows healthcare providers (HP) such as clinicians and nurses and their scores on Likert scale towards what their opinions were regarding various organisational factors such as HP Human Resources Capabilities, HP IT Infrastructure, Ease of Use, HP User Expectation and HP Operational Capabilities. Among all the organisational factors, HP User Expectation scored higher than the rest across all Healthcare Providers' job roles especially with the nurses, clinical technicians, clinical support workers and clinicians. Then followed by HP Operational Capabilities, HP Human Resources Capabilities, Ease of Use and lastly, HP IT Infrastructure in almost consistent manner across all job roles as shown above.



	HP Operational Capability	HP User Expectation	Ease of Use	HP IT Infrastructure	HP HR Capability
Small= 31	3.95	4.12	3.61	3.03	3.76
Medium= 60	3.83	3.93	3.38	2.68	3.63
Large= 70	3.88	4.20	3.56	2.55	3.88

Figure 7.2: Healthcare Provider (HP) Organisational Capability with HP Size

In Figure 7.2, HP User Expectation, HP Operational Capability and HP HR Capability scored higher compared to HP IT Infrastructure in terms of the size of Healthcare Providers Institutions.

The success of Telemedicine intervention could be influenced by various organisational factors and this is a general recognition reinforced by evidence from multi-disciplinary and health-specific researches. It is necessary to understand health-specific organisational factors if Telemedicine solutions and e-Health systems are to reach their potential in healthcare settings (Brear, 2006).

Studies suggested that failure in projects, such as implementing Telemedicine, is largely due to organisational and social factors, rather than technical factors and all the concerns identified as issues in the failure include, but are not limited to, understanding the needs of users of the system, as well as users' involvement in the development process, an improvement in the availability of resources, users' acceptance levels, the preparation of infrastructure projects to develop confidence and issues unrelated to the system itself (Fitzgerald and Russo, 2005). It has been observed that when an organisation aims at bringing any kind of change in their systems they consider their human resource as a component of change (Adeniji et al., 2013).

Dussault and Dubois (2004) stated that achieving healthcare goals for a population is being influenced by a provision level of accessible, high-quality, efficient, effective and viable services by healthcare personnel existing in adequate numbers and allocated appropriately across different professions and geographical areas. The change of clear human resources strategies is a critical linkage to healthcare policies and is necessary both to address the allocation differences of the healthcare personnel and to support reform implementation of the healthcare services. Likewise, Kabene et al. (2006) have found that the connection between healthcare services and human resources management is particularly complicated, specifically when observed from an international perspective. The research and analysis of Kabene et al. (2006) reported that a number of significant questions should be addressed and that human resources management should play an important role in healthcare sector improvement.

The result of this survey identified that Healthcare Provider HR capability had a positive influence on Telemedicine Readiness ($p < 0.001$ with contribution (Beta value) of 41.1%) and these findings are broadly consistent with those studies mentioned above and others. Similarly, the HP HR Capabilities have a significantly positive impact on Telemedicine Outcome Expectations ($p < 0.002$, Beta value of 20.2%). Although HP HR Capability and HP Operational Capability have a significant correlation ($r = 0.427$), HP HR Capability was not found influencing HP Operational Capability at least not directly, and this may be due to the fact, as explained by Ahmad and Schroeder (2003) who reported that, an examination of empirical articles issued between 1986 and 1995 in 13 Operation Management studies showed that less than 5% of these articles fell into the "human resources management for operations (HR)" domain.

This shortage of consideration is surprising when one thinks through human resources' crucial role in achieving greater healthcare practice at conflicting or variance priorities, such as quality, low cost, delivery, flexibility and innovation. Furthermore, Ahmad and Schroeder (2003) in their empirical study revealed that most HR policies influence operational routine and performance indirectly through organisational day-to-day practice. This finding is significant as it improves the understanding of the nature of relationship between operational performance and HR policies. Also, this finding proposes that managers planning to improve operational performance should generate a conductive organisational atmosphere that adopts employees' obligation to the organisation.

IT infrastructure is vitally significant to organisations working in dynamic environments and aiming to reengineer their business processes (Duncan, 1995). IT infrastructure is considered by many to be the major changing cause for competitive advantage and sustaining this advantage (Broadbent and Weill, 1997; Broadbent et al., 1999; Weill, 2002). Alsabawy, Cater-Steel, and Soar (2013) studied the relationships among IT capability intentions, IT infrastructure integration and quality of healthcare and the results concluded that IT infrastructure is the major component in solving a highly fragmented delivery system. The potential and the importance of an integrated IT infrastructure into healthcare systems have been noticed by both practitioners and researchers (Byrd and Turner, 2000).

The finding in this study regarding IT Infrastructure has a positive impact on HP Operational Capabilities and Telemedicine Readiness (p = 0.049, Beta value = 13.3% and p < 0.001, Beta value = 37.3%). That is in support of previous researches and it appears cannot be any different and that suggests that managers and policy makers as well as government officials in Libya should invest more in IT Infrastructure not only for the healthcare system, but also for the benefit of other public sectors and businesses to facilitate services such as, but not limited to, e-commerce, e-banking and e-learning.

In the current research, Organisational Learning Capability has a positive impact on HP Operational Capability (p = 0.036, Beta value = 15.2%) and this finding is consistent with and supports other researches. However, it was found that there was no link between Organisational Learning Capability and Telemedicine Outcome Expectations or Telemedicine Readiness. Organisational learning is the process by which organisations learn. Learning is any change in the organisation's models that maintains or improves performance (Cyert and March, 1963). Additionally, organisations should adopt a learning process that would help in bringing the learning capabilities of organisations and employees in use (Moustaghfir and Schiuma, 2013).

According to Jerez-Gómez et al. (2005), this learning process contains three aspects. The first would include the knowledge and its creation with its integration within an organisation. This develops the idea that organisational learning includes more than the individual learning of employees. The second would include creation and dissemination of knowledge and developing a constant internal change that would happen at the behavioural or cognitive level. The third would include constant improvement within system that would lead to improvement within the overall process of an organisation.

This would help the organisations in achieving "competitive advantage" in which the organisation's different learning capabilities would be used (Moustaghfir and Schiuma, 2013). Innovation consists of successfully implementing creative ideas within an organisation (Myers and Marquis, 1969) and based on previous studies it appears that innovation is closely related to the company's capability to learn, through which new knowledge is developed, distributed and used. Alegre and Chiva (2008) provided empirical evidence in their research that organisation's learning capability enhances product innovation performance.

It has been perceived that the operations of the organisation are significantly affected by any change in day-to-day activities. It would require organisations that are intending to bring any kind of change within an organisation to develop a proper plan for managing the operational activities of organisations (Liu et al., 2013). Ludwick and Doucette (2009) revealed in their research that no studies were found that compared how provider–patient interactions in interviews are effected when providers used electronic health information systems as opposed to the paper equivalent.

Similarly, Murray et al. (2011) reported that new technology was most likely to regularise areas that implementers observed had a constructive impact on communications between healthcare personnel and patients as well as within healthcare groups, and applicable to the existing personnel's set of skills and organisational goals.

7.2. Telemedicine Ease of Use

Chau and Hu (2002) further highlighted certain models were focused upon healthcare professionals' decisions to accept Telemedicine technology. These models include Technology Acceptance Model (TAM) and Theory of Planned Behaviour (TPB) that have been developed considering two of the well-known theories called theory of reasoned action (TRA) and Innovation diffusion theory (IDT) which are underlining the factors that would influence the behaviour of employees.

Technology acceptance studies in healthcare sector have highlighted the importance of the ease of use for healthcare professionals who have day-to-day tasks and duties that need to be accommodated. The level of perception of how easy Telemedicine technology is to use would affect both the perception of usefulness and the attitude towards actually using the technology (Chau and Hu, 2002).

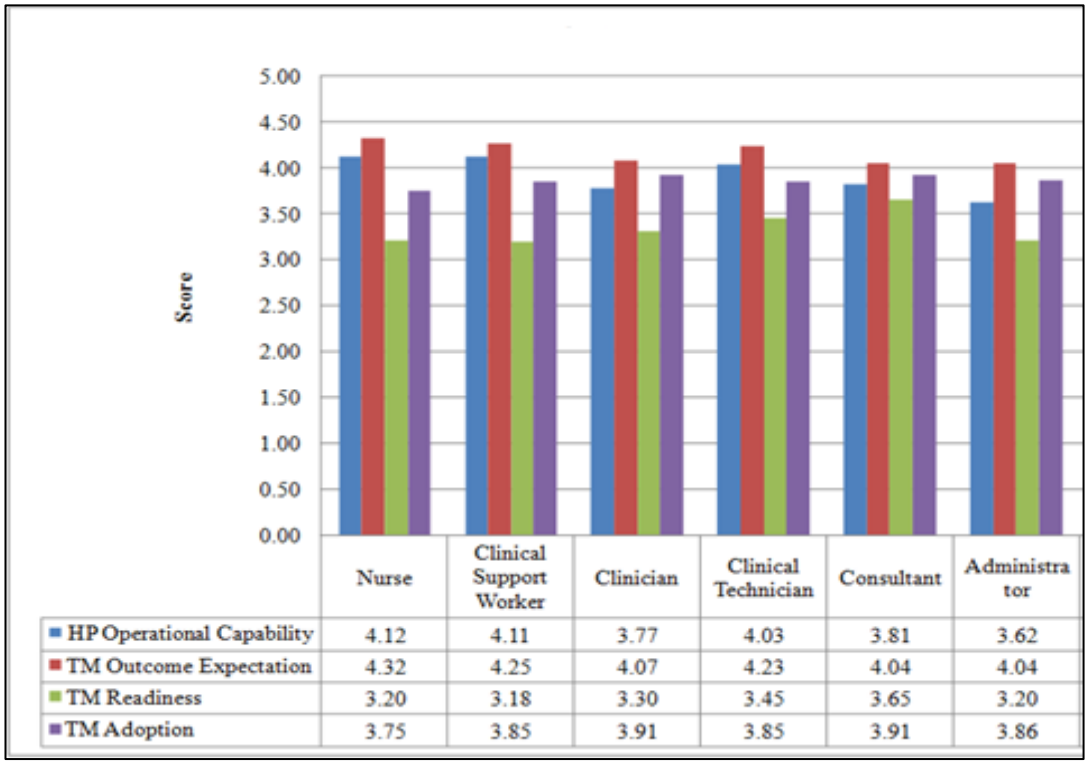
These studies mentioned above are in alignment with findings confirming that Telemedicine ease of use has influence on HP Operational Capability (p = 0.031, Beta value = 17.4%) and Telemedicine readiness ($p < 0.001$, Beta value = 26.5%). The above findings confirm that the ease of use of Telemedicine technologies will play a major part in determining organisational readiness in order to adopt and implement these technologies for healthcare providers. As further indicated by Yu et al (2009), managers should guarantee that an IT health application is useful and easy to use when introduced into a healthcare setting. Attention should be paid to creating an encouraging social norm to introduce the new technology or innovation and improve healthcare personnel's IT skills.

Green et al. (2006) found that at primary healthcare settings where clinicians have low acceptance rates of Telemedicine technologies to support healthcare provisions for patients with chronic conditions, successful application may require a set of applicable system and technology factors. In another study by Kutlu and Ozturan (2012), it was found that online application usage behaviour, attitudes about personal health data privacy and beliefs about health services all have significant unique effect on e-Health readiness. He has further added that his findings support and merge the findings of the previous studies.

Moreover, Yoo et al. (2013), found that within the program development or under reform category, application users were more often concerned about the ease of use, user interaction and task-oriented functionalities when using Telemedicine technologies such as the electronic health record system.

7.3. Healthcare Personnel Perspective

The opinions of physicians and other healthcare providers as the main users of Telemedicine are very imperative, as they will play a major role in the acceptance and adoption of Telemedicine technologies in the Libyan healthcare system. The findings of this study revealed that the majority of the healthcare providers (males and females similarly) believed that Telemedicine is a practical approach for providing healthcare services at a distance to patients instead of bringing the medical consultation of experts or sending patients from place to place. Additionally, it has the potential to save time, money and possibly lives. This has been indicated in Figure 7.3 below as Outcome Expectations scored higher across different job roles than other model outputs, whereas Telemedicine Readiness scored the least expressing the opinion of healthcare providers regarding more planning and work, such as a robust IT infrastructure, which should be done before adopting Telemedicine technologies.

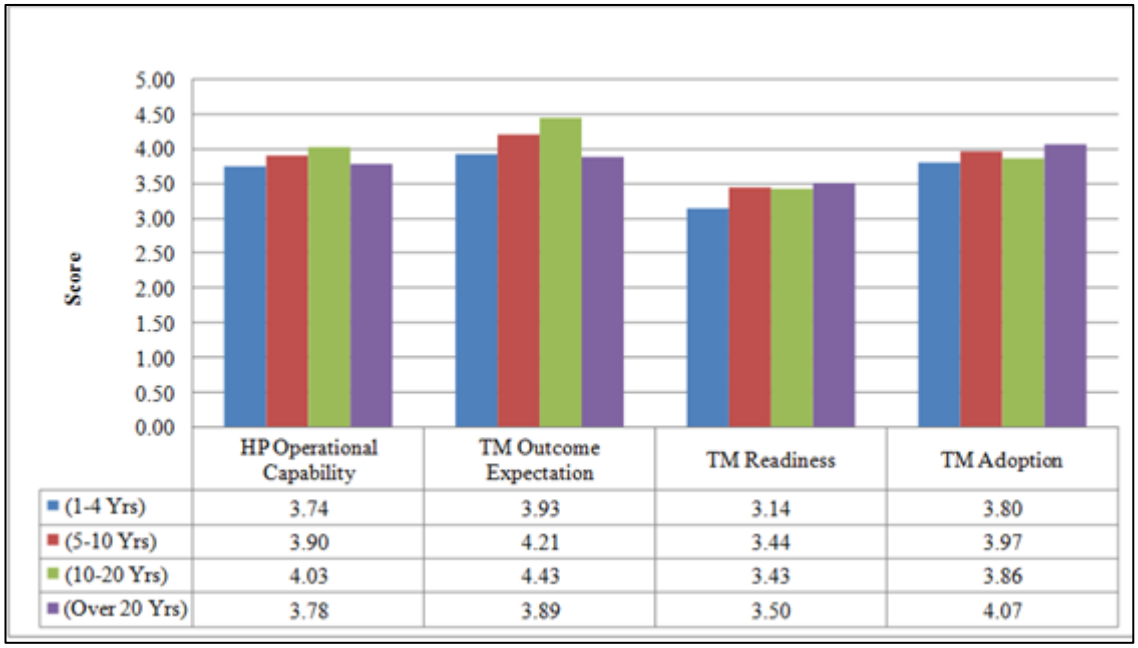


	Nurse	Clinical Support Worker	Clinician	Clinical Technician	Consultant	Administrator
HP Operational Capability	4.12	4.11	3.77	4.03	3.81	3.62
TM Outcome Expectation	4.32	4.25	4.07	4.23	4.04	4.04
TM Readiness	3.20	3.18	3.30	3.45	3.65	3.20
TM Adoption	3.75	3.85	3.91	3.85	3.91	3.86

Figure 7.3: Model's Outputs by Participants' Job Roles

In the current survey, certain sample profile characteristics have been addressed and studied concerning Telemedicine outcomes in Libya. T-test and ANOVA test findings showed that the group of age range (35-44) years old has influence on Telemedicine Readiness and that impact was more optimistic toward Telemedicine Readiness compared to the group of age range (22-34) years old.

(5-10 years, and 10-20 years) years of experience groups had positive opinion in term of Telemedicine Outcome Expectation and Telemedicine Readiness compared to the less experienced group (1-4 years). These mentioned groups represent the majority of any organisation's work force and any differences between these groups will affect the organisation's capabilities such as operational ones. Figure 7.4 below further enhances the results of the ANOVA test.

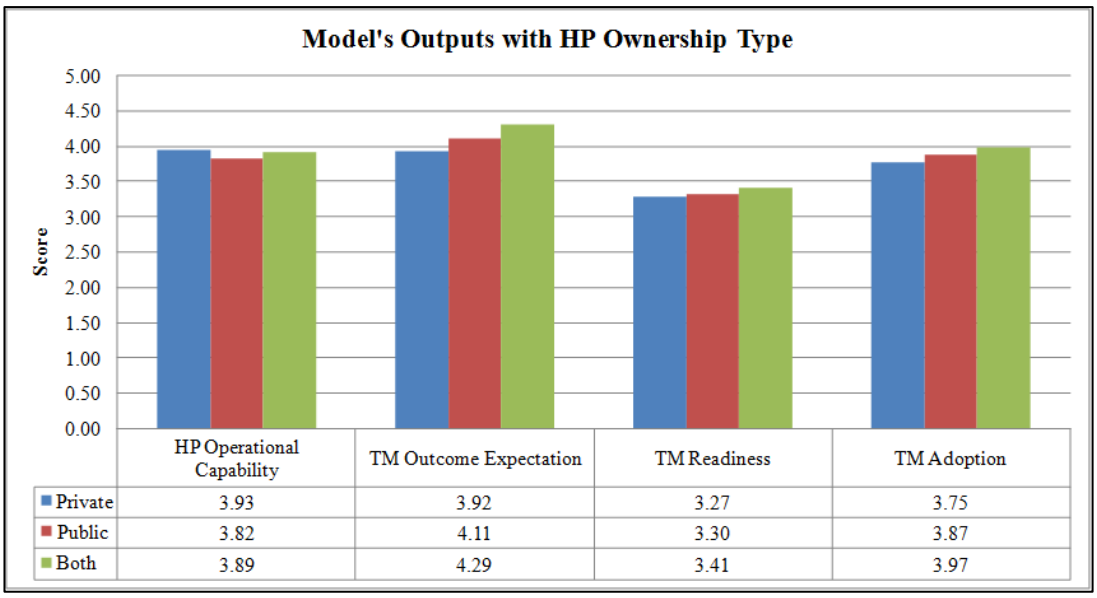


	HP Operational Capability	TM Outcome Expectation	TM Readiness	TM Adoption
(1-4 Yrs)	3.74	3.93	3.14	3.80
(5-10 Yrs)	3.90	4.21	3.44	3.97
(10-20 Yrs)	4.03	4.43	3.43	3.86
(Over 20 Yrs)	3.78	3.89	3.50	4.07

Figure 7.4: Model's Outputs by Participants' Years of Experience

According to Nelsey (2012), issues that appear when there are variances in age and experiences among workforce, have been the focus of examination since the 1990s across different range of work environments. She further added that a number of differences have been observed due to the generation gap which has highlighted the fact that freshly graduated individuals are relatively more confident and freely communicating rather than their older counterparts, however, they are in frequent need of feedback and assistance to merge with the organisation.

Employees from the younger generations are exposed to more technological advances than past generations and they are comfortable using computers, networking and interfacing, however that does not translate into them having the appropriate IT skills required for use in the workplace (Zacher and Schmitt, 2016). The older, more experienced generation value learning and training opportunities more (Brownie and Horstmanshof, 2012) which reflects their positive opinion of Telemedicine in this research.



	HP Operational Capability	TM Outcome Expectation	TM Readiness	TM Adoption
Private	3.93	3.92	3.27	3.75
Public	3.82	4.11	3.30	3.87
Both	3.89	4.29	3.41	3.97

Figure 7.5: Model's Outputs with Healthcare Providers' Ownership Type

ANOVA test result for types of healthcare providers' factor and its impact on model's outputs demonstrated that groups who are working in private sectors and groups who are working in both (private and public sectors) was significant (p = 0.042) in terms of Telemedicine Outcome Expectation and multiple comparisons result showing that healthcare providers working in the private sector are less optimistic than those working in both (public and private sectors). Figure 7.5 further illustrates this finding.

Benefits of using Telemedicine are expected, as several research studies have confirmed. However, the findings are contrary to previous studies that found that some developing countries held attitudes associated with cultural background that would be less enthusiastic or negative towards technology, especially when organisations do not consider cultural issues (Straub et al., 2002; Al-Gahtani et al., 2007; Twati and Gammack, 2006).

In this study, the main factor that was perceived by the healthcare providers which will act as an obstruction to the implementation of Telemedicine technologies in the Libyan healthcare system was the non-existence or weakness of IT infrastructure in Libya at present, such as IT systems and networks connecting patients with providers or providers with providers. All the healthcare types within their own establishments were deficient regarding internet connections and the use of IT systems. This deficiency would further hinder the deploying of Telemedicine technologies in the Libyan healthcare system.

Puskin and Sanders (1995) reported that clinicians accepting a technology remain to be a concern yet to be determined. Some clinicians' resistance, which was observed, is related to their perception of relative complication of the currently-used systems. They further added that, if Telemedicine systems are to be successful, they must be perceived as useful and of value to the patients and practitioners who would use them. Hu et al. (1999), in their study to examine Davis's model (TAM) using 408 clinicians' acceptance of Telemedicine technology (that tend to be treated as tools), explained that for the technology to be used, it can only be acceptable if desired functionality in the clinicians' daily practices has been established. They further argued that TAM model might not be suitable for the clinicians as technology users, as they have noticeably above-average intellectual capacity and general ability to materialise the use of the technology as well as accessibility to constant and reliable technical assistance. Since the technology has advanced in many areas such as smartphones where they become increasingly ubiquitous it reduces the issue of TAM aspects in terms of devices' availability used in workplaces. However, the ease of use is still a factor with regard to operational activities in clinical setting.

The current research, although HP User Expectations has medium correlation (r = 0.305) with Telemedicine Readiness, did not have an influence on Telemedicine Readiness (p = 0.823 > 0.05). However, with HP Operational Capability and Telemedicine Outcome Expectations, HP User Expectations was significant for both (p < 0.001) explaining variance of 50.6% and 31.4% respectively. A possible explanation for this might be that healthcare providers are pragmatic and trying to point out that they are not ready yet to utilise Telemedicine technology into their daily routine yet, however they see the operational benefits of adopting this technology and they are expecting better outcomes.

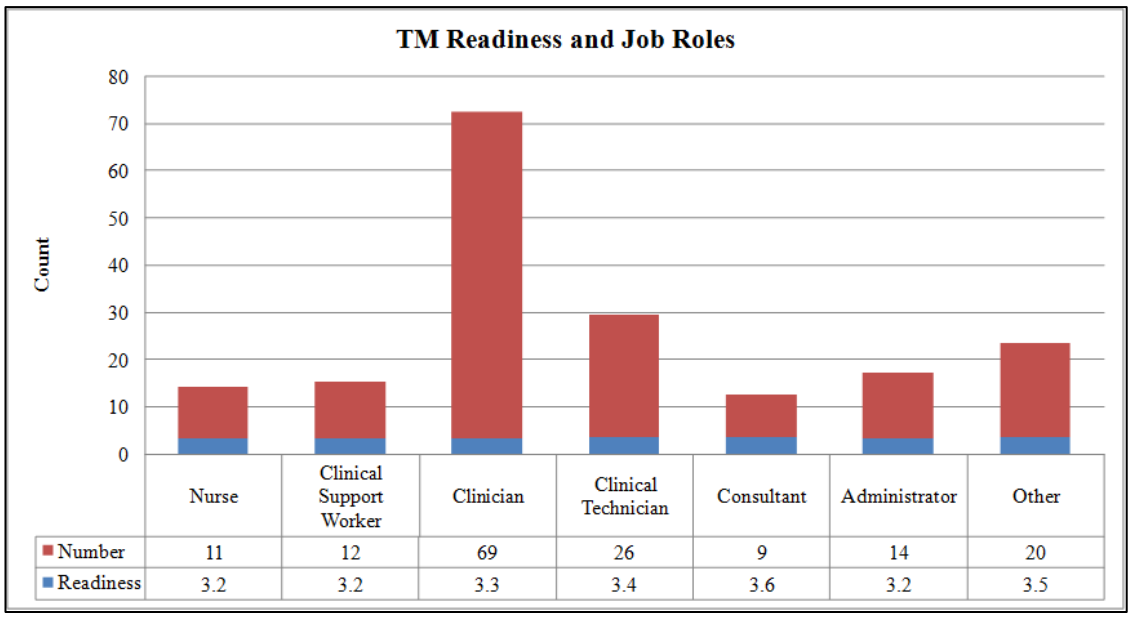
7.4. Telemedicine Readiness

Adoption usually starts with the recognition that a need exists and moves to searching for solutions, then to the initial decision to attempt the adoption of a solution and finally to the actual decision to attempt to proceed with the implementation of the solution (Wisdom et al., 2014). Jennett et al. (2003) claimed that to evade expensive implementation mistakes, a better understanding of the factors within organisational readiness could be needed. They continued stating that readiness could be systematically assessed and that might be critical for successful and sustainable service provisions or products. Weiner et al. (2008) stated that professionals and healthcare practitioners observed that organisational readiness for change is an important precursor for adoption and implementation to be successful.

In this study, the strongest relationships were between Telemedicine Readiness and the following: HP HR Capability (r = 0.537), IT Infrastructure (r = 0.445), Telemedicine Ease of Use (r = 0.415) and HP User Expectations (r = 0.305). However, Learning Capabilities (r = 0.18) showed weak relationship with Telemedicine Readiness. The regression analysis findings showed that HP HR Capability, HP IT Infrastructure and Telemedicine Ease of Use have a significantly positive influence on Telemedicine Readiness with variance (R^2) of 41.1%, 37.3% and 26.5% respectively.

These findings are fairly similar to other studies. If HP human resources were re-located or managed well (with consideration to personal development and technology acceptance), and if the IT infrastructure does exist and is active in order to facilitate the changes as well as if the Telemedicine technologies were easy to use, then the healthcare organisations should be considered ready to adopt and implement these technologies to improve healthcare provision services.

Jennett et al., (2003) stated that the readiness concept should be inspected to all required resources prior to the implementation of e-Health systems and Telemedicine technologies. These resources could be associated with human, organisational and technical matters. That way any implementation's barrier inside the organisation can be assessed and considered, including, but not limited to, risk anticipation, lack of time, inadequate financial resources, users' resistance to change as well as insufficient technical knowledge and skills.



	Nurse	Clinical Support Worker	Clinician	Clinical Technician	Consultant	Administrator	Other
Number	11	12	69	26	9	14	20
Readiness	3.2	3.2	3.3	3.4	3.6	3.2	3.5

Figure 7.6: Telemedicine Readiness by Participants' Job Roles

Figure 7.6 and Figure 7.7 provide indications for managers to expect who is most willing among healthcare providers to adopt Telemedicine technologies, and they are the Consultants, Clinical Technicians and Clinicians (considering their count number of 69) within the groups of 5-10 and 11-20 years of experience. These expectations will allow managers to identify innovators and early adopters to lead the others within an organisation to successful implementations of Telemedicine projects. The observation, from the large literature review related to the organisational readiness, is divided into two categories.

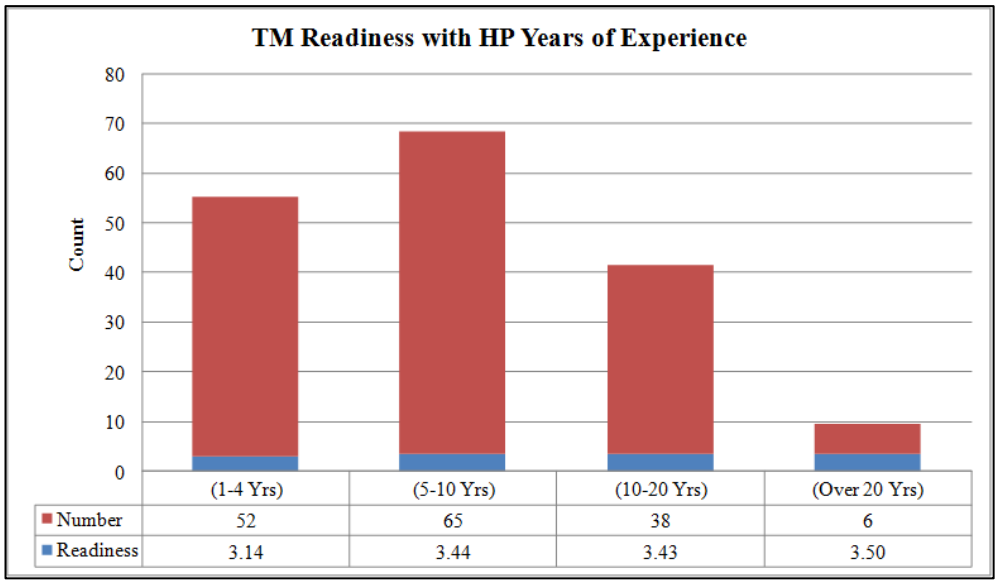


Figure 7.7: Telemedicine Readiness by Participants' Years of Experience

The first one is readiness in psychological terms, highlighting workforce's attitudes, views, and objectives. The second category is readiness in structural terms, underlining organisational capabilities and resources. Weiner (2009) underlined the importance of shared beliefs and collective (or conjoint) capabilities as the implementation process requires co-operative action among individuals as well as work teams or groups. Managing action across many individuals and groups and supporting organisational learning are examples of such collective (or conjoint) capabilities.

The focus should be directed on readiness, which was defined as individual's beliefs, attitudes, and intentions regarding the extent to which changes are needed and the organisation's capacity to successfully undertake those changes (Rafferty et al., 2012). Readiness is comprised of both individual difference and structural factors, reflecting the extent to which the organisation and its members are inclined to accept, embrace and adopt a particular plan. It has been observed that in today's world, the organisations are investing in the readiness process in which the integration of all the influencing factors is done to make the procedure successful and should help them in developing their productivity and efficiency (Holt and Vardaman, 2013).

7.5. e-Health Systems Adoption

It was highlighted that there are various organisational factors which tend to influence technology adoption. Four main aspects described include external environment (such as competitive pressures as well as consumers and governments), technological (such as perceived benefits, complexity, and the compatibility), and individual and organisational factors (such as organisational size and IT expertise) which influence technology adoption (Camisón-Zornoza et al., 2004). On the contrary, Vaccaro et al. (2012) examined in their study the infusion and diffusion within the organisations that further explained technology adoption within the organisations.

With regards to Telemedicine Adoption in this research, the strongest relations were found with HP HR Capability (r = 0.63), HP User Expectations (r = 0.598), Service Users Acceptance (r = 0.409), Telemedicine Ease of Use (r = 0.375) and Telemedicine Current Access (r = 0.321). HP IT Infrastructure (r = 0.216) and HP Learning Capabilities (r = 0.215) have weak relationships. Furthermore, it was found that Telemedicine Adoption had relations with the model's outputs as follows: Telemedicine Readiness (r = 0.56), Telemedicine Outcome Expectations (0.557) and HP Operational Capability (r = 0.396).

In the regression analysis, it was found that Telemedicine Readiness (influenced by Telemedicine Ease of Use, HP IT Infrastructure and HP HR Capability), Telemedicine Outcome Expectations (influenced by HP User Expectations and HP HR Capability) and HP Operational Capability (influenced by HP User Expectations, Telemedicine Ease of Use, HP Learning Capabilities and HP IT Infrastructure) have a positive significant impact ($p < 0.001$) on Telemedicine Adoption with Beta values of 40.2%, 36.7% and 12% respectively.

In addition, descriptive results showed that the types of Telemedicine technologies mostly used are interactive (31%) such as telephones and emails, Electronic Medical Record (21%) and Educational (15%). The respondents indicated little use of Remote Monitoring only (2%) and Live Video Consultations were not used by the participants.

These findings indicate that in order to adopt Telemedicine technologies in Libyan healthcare establishments, the focus should be on their human resources capabilities and the first line clinical staff such as clinicians and nurses with consideration to their involvement in innovation plans as well as enhancing their knowledge and technological skills ensuring that the introduced Telemedicine technologies' compatibility or day-to-day practice should not be affected and it should be easy to use. Furthermore, the IT infrastructure should be highly taken into account and it should be invested in its development, not just within the organisations, but also within the whole region or nationwide. These recommendations should provide access to healthcare service users, especially the population who are living in the rural areas and who were diagnosed with chronic diseases, where their healthcare management may be reviewed remotely.

The use of technology and its rejection is deemed to be an intention in making the behaviour and this intention is being affected by individual attitude as well as by the subjective norms in relation to the behaviour (Sheppard et al., 1988). There are various factors which tend to influence the technology adoption (Hameed and Counsell, 2014). Four main aspects described include environmental, technological, individual and organisational factors which influence technology adoption. Within the technological aspect, there are several associated aspects that are found, including the perceived benefits, complexity, costs and the compatibility as the key resources and determinant. On the other hand, there are the organisational characteristics, which discuss the organisational size, top management support as well as IT expertise that are relevant to the organisation (Camisón-Zornoza et al, 2004).

7.6. Results Validation

Interviews were conducted to validate and support quantitative results obtained by the survey-based questionnaires. These interviews discussed the factors and findings from the survey, including User Expectations, TM Ease of Use, HP Learning Capability, HP IT Infrastructure and HP HR Capability (see Appendix C).

The interviews were taking place during February, 2019 with three Libyans at managerial positions, with medical backgrounds and years of experience working for different healthcare providers. The interviews took place using communication technology where participants were in Libya and the researcher was in the UK. The duration of interviews was between 30 minutes to 1 hour. An ethical approval was obtained from Brunel Ethical Committee in January, 2019 to conduct these interviews. An information sheet, a covering letter and a consent form were sent to participants before the interviews to guarantee the privacy of their information and to introduce the study to them for better understanding (see Appendix B). Table 7.1 shows the interviewees' profile.

Table 7.1 Interviewees' profile

Number	Gender	Job Role	Years of Experience
1	Female	Head of Medical Equipment's Supply and Crisis Committee Member at Ministry of Health	26
2	Male	University Hospital Manager and Consultant Physician	30
3	Female	Private Clinic Manager, Dentist and Research Mentor	15

The interviews were helpful in confirming the findings from the survey and this result increased the validity of the study. Table 7.1 shows participants working at decision-making level within their organisation with years of experience between 15 and 30 years of experience. Furthermore, the interviewees were selected from various healthcare organisations in both, the public and private sector.

According to the participants in the validation interviews, they all agreed that the relationships within the framework model are reasonable and from their perspective, they added the following comments:

"*The provided framework is comprehensive. It contains all parameters that are essential for Telemedicine Readiness in healthcare system particularly at tertiary level such as in referral and specialised hospitals. Moreover, healthcare providers can apply the same framework at the secondary level of healthcare system*". This response indicates that the level of a hospital or healthcare centre in a national network may have implications in terms of available infrastructure and Telemedicine Readiness.

The second participant said:
"*Well organised, constructive, very applicable to the healthcare system in Libya and the overall findings have a very significant impact*"

The third participant said:
"*It looks very connected and associated with the existing literature, such a model for developing countries is crucially important. Readiness assessment can help to improve the chances of successful implementation by identifying the stakeholders and the factors that should be targeted. In this case, should we use your model as an assessment tool in Libya? The financial resources and business factors should be included. Groups of other participants need to be included such as answers from patients and the public, as I understood that you had just the healthcare providers and clinicians*". The respondent highlighted that in the healthcare system other stakeholders' perspective is necessary for the change of healthcare service provision using Telemedicine technologies.

The result in regard to TM Readiness was presented to the participants and it showed that there were positive impacts between TM Ease of Use, IT Infrastructure and HP HR Capability with TM Readiness. However, there was no impact of User Expectation and HP Learning Capability on TM Readiness. The interviewees responded to these results as follows:

"Yes there would be positive impacts between TM Ease of Use, IT Infrastructure and HP HR. In contrast, there should also be positive impact regarding user expectations and HP Learning Capability".

The second participant said:

"*I completely agree with this result that there should be good IT infrastructure and the criteria of human resources. Furthermore, facilities (TM technologies) should be easy to use to provide services to patients".*

The third participant said:

"*It was not surprising that there were positive impacts between TM Ease of Use, IT Infrastructure and HP HR Capability with TM Readiness because those factors are encouraging in using a new service provision and do not need as much work from users to be done in advance. However, from my point of view the User Expectation factor will influence TM Readiness because it (TM technologies) will need extra duties from the (healthcare) providers by increasing the number of workers and job opportunities particularly IT experts. In Libya, most of the organisations are not depending on IT services, which is why we do not have any previous experiences. On the other hand, HP Learning Capability should have impact on TM Readiness, too. Any technological system needs learning, improvement, and maintenance and to be updated regularly, thus the financial part is equally as important".*

The findings of positive relationships between HP Operational Capability and most of the Organisational Capabilities presented in the model, but not with HP HR Capability, were showed to the interviewees and their comments were as follows:

"*Yes, I agree with the first part regarding the positive relationships between User Expectations, TM Ease of Use, HP Learning Capability, HP IT Infrastructure and HP Operational Capability while I disagree with the second part of the question to some extent".*

The latter comment highlights beliefs among healthcare professionals that human resources aspects are a concern. The final respondent also highlights this point.

The second participant said:

"*Operation will always be impacted by different input parameters and I agree with the ones presented in the model.*"

The third participant said:
"I a*gree with this finding because Operational Capability will have association with different factors as well as with Human Resources. This technology will help improve patients' management and will help doctors and healthcare providers to work effectively without mistakes (medical and administrative) and delays. The technical issues will affect most of other factors. For example, if the internet stopped working or the patients' details were breached this would have negative effect on the service (provision)*". This respondent emphasised problems which correspond with developed countries.

The interviewees agreed with the findings when they were asked their opinions on TM Outcome Expectation that had positive relation with HP User Expectation and HP HR Capability, but not with TM Ease of Use, HP Learning Capability and IT Infrastructure.

The participants' opinion on the study framework's impact on the healthcare service provision in Libya in particular for chronic disease patients, was as follows:

"*From my point of view, there is a largely positive impact on the healthcare service, especially in the area of chronic disease patient management and on high precision surgical operations such certain kinds of tumours and spinal cord operations that require a highly professional team. This team can deal easily and quickly with the advice they need from their colleagues who are highly qualified from other global institutions abroad*".

The second participant said:
"*It is a very positive approach to provide care to patients in order to relive their medical conditions through care and follow up*".

The third participant said:

"*Those tools or systems definitely work for the patients and will help healthcare providers, as well, if we use them legally, humanly and under a medical law. Furthermore, the implementation of appropriate security measures is required during saving and transferring the data*".

The purpose of conducting interviews was to support the findings of the questionnaire. Therefore, interviews were conducted with healthcare provider experts in Libya. The findings of the interview have supported the model and have validated the revised conceptual model. They did not reveal any major issue or concern regarding the revised conceptual model.

7.7. Discussion summary

The current research attempted to elevate healthcare to reach the point of patient-centred care by utilising Telemedicine. Furthermore, it has identified Telemedicine organisational factors such as HP HR, IT Infrastructure, technology Ease of Use and healthcare providers' perspective, which will have impact on Telemedicine Adoption and thus on the implementation of such technology. The next chapter will conclude this research by highlighting academic and practical implications, limitations, and suggestions for future studies.

Chapter Eight: Conclusion

This chapter summarises the study's main findings, research contributions to knowledge, managerial implications, study limitations and possible future research.

Libyan healthcare organisations, with limited resources, are required to provide medical services to all inhabitants regardless of where they are, hence e-Health systems and Telemedicine solutions are considered as a potential support to the existing healthcare services or perhaps as an alternative in some healthcare stages such as patient's management. Telemedicine might be a practical approach to provide distance healthcare services to patients instead of sending them from place to place. Furthermore, it has the potential to save time, money and possibly lives. It is important for healthcare providers to facilitate an easy access to healthcare service users especially the population living in rural areas and those diagnosed with chronic diseases where their healthcare management may be reviewed remotely. The study's aim was set out to assess the concept of Telemedicine Readiness at an organisational level in Libya, and has identified the healthcare providers' perspective, and the influence of various health-specific organisational factors including organisational capabilities and resources on the study outcomes. The research was conducted using a quantitative and qualitative approach. This was done successfully to achieve the research aims and research questions. In the main field study, a questionnaire-based survey was employed and distributed to a population of 620 individuals (mainly clinicians), reduced to 520 after exclusions and the respondent's total was 161. The targeted population was on training programmes and studying for further education in the UK and working as healthcare providers in Libya. This research has found that various organisational factors have an impact on Telemedicine Readiness and thus on the implementation of such technology including Healthcare Provider (HP) HR, IT Infrastructure, technology Ease of Use and healthcare providers' perspective. In the regression analysis, it was found that Telemedicine Readiness [influenced by Telemedicine Ease of Use, HP IT Infrastructure and HP HR Capability ($p < 0.001$, $R^2 = 0.472$)], Telemedicine Outcome Expectations [influenced by HP User Expectations and HP HR Capability ($p < 0.001$, $R^2 = 0.522$)] and HP Operational Capability [influenced by HP User Expectations, Telemedicine Ease of Use, HP Learning Capabilities and HP IT Infrastructure ($p < 0.001$, $R^2 = 0.353$)] have a significantly positive impact on Telemedicine Adoption ($p < 0.001$, $R^2 = 0.477$).

8.1. Summary Of Research Findings

This research found that the types of Telemedicine most used by healthcare professionals, in large and medium-sized healthcare providers compared to small-sized healthcare providers, are the interactive type (31%) such as telephones and emails, the electronic medical record (21%) to access patient's data and to be used for educational purposes (15%). There was little use of remote monitoring (2%) and no use of live video consultations. Additionally, the main organisational factor that was perceived by the healthcare professionals to act as an obstruction to implementing Telemedicine technologies in the present Libyan healthcare system was the lack of robust IT infrastructure. According to the World Health Organisation (WHO), Telemedicine is more integrated in developed countries as it improves the operation of healthcare services, reduces costs, and makes information available faster when and where is needed. However, in less developed countries, access to the required technology is an issue. It is argued that Telemedicine makes healthcare provisions more efficient and easier to managing data as well as patients' treatment plans. Furthermore, the internet and web-based sites offer broader access to health educational materials, and open a window for collaboration between various healthcare organisations and researchers, which has been accelerated recently by the rise of cloud computing.

In order for Telemedicine to be adopted by healthcare organisations, researches should examine organisation Readiness for change focusing on certain organisational capabilities such as the technical infrastructure and stakeholders' involvement. It is important to assess the Readiness of the stakeholders (including medical, technical and administration staff) and measuring their readiness can be achieved through a suitable approach in terms of methodology. The importance of the Readiness concept appears in many literatures by various scholars because it can mitigate the failure of adopting and implementing new healthcare delivery system where these types of changes are more often linked to wasted effort, time and money. It is argued that Telemedicine Adoption failures are typically associated with individuals (such as medical staff resistance to system change), time and funding limitations with less evident health outcomes. Therefore, several recommendations regarding Telemedicine implementation in the North African region were made by the WHO in 2001 in Cairo, Egypt.

This plan of action asked the governments to establish an infrastructure to be ready for Telemedicine implementation. This confirms the need for Telemedicine to deliver healthcare services regionally or nationally to support healthcare services achieving access for all.

8.2. Research Findings from Regression Analysis

It was found that the healthcare organisation's size has an influence on Telemedicine Readiness and Telemedicine Adoption (p= 0.006 and p= 0.041) respectively. The small-sized healthcare organisation group showed their support to Telemedicine Readiness and Telemedicine Adoption more than the medium-sized healthcare organisation group. Furthermore, it was found that Telemedicine Readiness has strong relationships with Human Resources, IT Infrastructure, Ease of Use and User Expectations. The regression analysis findings showed that Human Resources, IT Infrastructure and Ease of Use have a significantly positive influence on Telemedicine Readiness. Telemedicine usage in Libyan healthcare establishments is largely driven by two factors within the human resources domain: a positive perception of benefits or expectation and the norms or the influence of others in the working environment. Based on the findings in this research, it is believed that the Readiness concept in healthcare organisations can be divided into two categories. The first category is Readiness in psychological terms, highlighting workforce's attitudes, norms, views, and objectives. The second category is Readiness in structural terms, underlining organisational capabilities and resources.

The findings show that (5-10 and 10-20) years of experience groups demonstrated positive support toward Telemedicine Outcome Expectation (p= 0.031, p= 0.001, respectively) compared with the less experienced group (1-4 years). Telemedicine Outcome Expectations was influenced by User Expectations and Human Resources. Additionally, HP Operational Capability was influenced by User Expectations, Ease of Use, Learning Capabilities and IT Infrastructure. HP User Expectations had a positive impact on HP Operational Capability and Telemedicine Outcome Expectations. This indicates that healthcare providers are recognising the operational benefits of such technologies and have high expectations of utilising it in their daily routine.

8.3. Research Contribution to Knowledge

Telemedicine is understood to be founded on information systems with the host of healthcare sector. Furthermore, information systems are a combination of two main arenas: computer science and management. Thus, this research is believed to have made contributions to knowledge in all different mentioned fields of computer science, innovation management and healthcare service provision as well as academically, as follows:

1. To the best of the researcher's knowledge during the time of research, this study is the first empirical study to examine Telemedicine Readiness and Telemedicine Adoption at an organisational level in Libya. It contributes to the body of knowledge facilitating Telemedicine implementations in the North African region, particularly in Libya.

2. Assessing Telemedicine Readiness has been done through examining factors that are relevant to individuals, organisational and technical structure. The study further contributes to existing research through its analysis of these issues based on the combination and extension of existing theories and models in different arenas of computer science, innovation management and healthcare service provision. This is the first study that addresses all of these subjects together.

3. This research has brought some valuable insights to the existing literature concerning Telemedicine implementation in the Libyan healthcare system by identifying organisational factors and medical professionals' perspective. Organisational Learning Capability has a positive impact on Operational Capability. Therefore, organisations should adopt a learning process such as creating, spreading and supporting knowledge.

4. Designing, developing and validating a conceptual framework as a measurement tool of Telemedicine Readiness and e-Health Adoption in Libya which could be used in other developing countries. Additionally, the enhanced framework could be used in developing and developed countries alike as it contributes by

addressing important issues concerning strategy and policy making at an organisational level for possible Telemedicine deployment.

5. This research and its validated tool could be of great interest to many companies around the world specialising in information systems and Telemedicine solutions where they could invest their money, knowledge and expertise into an unknown region of North African countries such as Libya. Therefore, the study can contribute directly to any future planning towards Telemedicine business projects in Libya. Furthermore, this study can aid Libyan healthcare policy makers to understand which organisational factors make great contribution towards healthcare outcomes if Telemedicine solutions were implemented.

6. The results and findings of this research are to be published in the International Journal of Technology and Human Interaction Technology and Innovation: A Half-Century of Internet-Enabled Change (IJTHI) which will be accessed online. This article will be used by future researchers to expand their understanding on Telemedicine Readiness and healthcare sector in developing countries.

7. In terms of existing literature on healthcare organisation and innovation management, this research highlighted the affiliation with human resources and operational capabilities in an organisation. The finding in this regard narrows the gap explained by Ahmad and Schroeder (2003) in their study where they stressed that there is a lack of empirical studies into the human resources management for operations in healthcare setting.

8.4. Managerial Implications

This research provides healthcare policy makers with important insights on how to facilitate the adoption of Telemedicine solutions as well as helping them to understand which healthcare organisational factors make the greatest contribution towards successful Telemedicine implementation. What has been learnt in this study, which could help the healthcare decision making process in order to adopt Telemedicine technologies, is as follows:

Telemedicine Outcome Expectations scored higher across different job roles than other model outputs, whereas Telemedicine Readiness scored the least. This expresses the opinion of healthcare providers towards more planning and work, such as establishing a robust IT infrastructure, which should be done before adopting Telemedicine technologies. It was found that IT Infrastructure has positive impact on HP Operational Capabilities and Telemedicine Readiness. Furthermore, healthcare providers are deficient in necessary internet connections and the use of IT systems. This deficiency would further hinder the deploying of Telemedicine technologies in the Libyan healthcare system.

The (35-44) years old age range group was more optimistic toward Telemedicine Readiness compared to the (22-34) years old age range group. Furthermore, the (5-10 years, and 10-20 years) years of experience groups were positively significant in terms of Telemedicine Outcome Expectation and Telemedicine Readiness compared to the less experienced group (1-4 years). These mentioned groups represent the majority of any organisation's workforce and any differences between these groups will affect the organisation's capabilities such as operational ones. Consultants, Clinical Technicians and Clinicians (largest groups) within the groups of (5-10) and (11-20) years of experience, especially those working in large and medium-sized healthcare organisations such as hospitals, indicated that they are ready to adopt e-Health systems and Telemedicine technologies.

The groups working in the private sector and groups who are working in both (private and public sectors) were significant in terms of Telemedicine Outcome Expectation with indicating that groups working in the private sector are less optimistic than the ones working in both (public and private sectors). In Libya, most of the private sector is small-sized healthcare providers and that means less work load compared to the public sector where most of large-sized healthcare providers are operating to deliver healthcare services. This may explain the positive attitude towards Telemedicine solutions, which might help and support their day-to day tasks and routine and possibly reduce the workload with more efficient clinical outcomes.

8.5. Answering Research Questions

The following research questions were formulated to investigate factors that may have impact on Telemedicine Readiness and Adoption at an organisational level in the Libyan healthcare system:

RQ1. What are the main organisational factors that might have impact on Telemedicine Readiness in Libya?
A comprehensive background study was carried out to identify potential organisational factors influencing Telemedicine Readiness in developing countries which were then tested empirically.

RQ2. Which of the outcome measures will influence the acceptance of Telemedicine projects and e-Health systems in Libya?
A field study was carried out to examine the impact of the outcome measures in facilitating acceptance of Telemedicine projects and e-Health systems. The raw data was statistically analysed using SPSS and then presented in chapter 5, 6 and 7.

RQ3. What organisational capabilities and resources affect e-Health adoption in the Libyan healthcare system?
A field study was carried out to identify and examine key organisational capabilities and resources influencing e-Health adoption in the Libyan healthcare system. The raw data was statistically analysed using SPSS and then presented in chapter 5, 6 and 7.

8.6. Research Limitations

Even though the researcher has given the best of his time and effort, there are inevitably limitations in every study. The researcher used a cross-sectional survey within a certain time frame and that limited definite information about the cause and effect of the existing relationship between the study factors. The cross-sectional survey was preferred as the researcher has limited time and resources and furthermore, convenient sampling technique was used due to the geopolitical issues surrounding Libya being war-zone country and that might have limited the access to a larger population.

The situation in Libya following the Arab Spring limited the ability to contact healthcare professionals in Libya and to conduct this research, an alternative route to participants was sought. This may limited the available population to those attending the UK hence limiting the study and it may not be representative of the healthcare professionals' population in Libya and would encourage the results to be more accurate and closer to actuality.

Telemedicine Readiness and e-Health System Adoption are intersectional and complicated topics and this study focused on the perspective of the healthcare providers rather than the patients' perspective. Hence, further investigation into the patients and their carers' perspective is required in the future for a better and wider view of how such technologies can be established. The decision was taken as it would have made the research objectives unreasonable to investigate patients' perspective due to the security issues and the political instability in Libya.

There are limited existing studies on Telemedicine Readiness in Libya, so the results of this research may not align with findings from other Telemedicine research.

8.7. Recommendation for Future Study

The following are recommendations for future research directions, which may be of interest to future researchers:

1- Since this study focused on the Libyan healthcare system, it would be interesting to use the research model developed to further examine whether the model can be extended to other developing countries.

2- Other researchers may use a longitudinal research design approach to examine the cause and effect of the existing relationship existing between the model factors as well as to detect organisational changes that may affect the outcomes of this research over a period of time.

3- A study to examine the perspective of the healthcare users such as patients and carers has the potential to facilitate Telemedicine Adoption in developing countries.

8.8. Chapter Summary

This research made a substantial contribution, despite the limitations, in the fields of computer science, innovation management and healthcare service provision. The research proposed a conceptual framework to understand Telemedicine Readiness in Libya and developing countries in general. Telemedicine technology is an innovative healthcare delivery option and it is believed that the findings in this study will be of assistance to policy makers in providing insights and guidance in order to implement Telemedicine solutions into the Libyan healthcare system. The study has fulfilled its aims, objectives and answered all research questions set at the beginning of this research.

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Appendix A: Survey Questionnaire

Ali Abdullrahim March 4, 2014

Brunel UNIVERSITY LONDON

A study of using telemedicine to provide healthcare in North Africa

Telemedicine (TM) is the use of **Information Communication Technology (ICT)** to provide healthcare from distance to the service users. This questionnaire is for a current study to determine the benefits and readiness to adopt and implement telemedicine in order to **provide healthcare (PH/ HP) services** to patients with chronic conditions in North Africa. Answering all sections in this questionnaire will help us to reach a fine result in the study and your participation will be valued and appreciated. We confirm that the obtained information will be anonymous and confidential.

If you have any enquiry regarding the questionnaire, please do not hesitate to contact on the following email address: ali.abdullrahim@brunel.ac.uk

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Section A

Information here is about you and your work place or healthcare provider.

1/ HP Profile					
Gender / Age	**21 & Under**	**22-34**	**35-44**	**45-54**	**55 & Over**
Male					
Female					

What is your job title?

☐Nurse. ☐Clinical support worker. ☐Clinician. ☐Clinical Technician. ☐Consultant.

☐Administrator. ☐Other, please specify:_____

Clinical Experience (Years)	Educational Level (eg: PhD)	HP Type (private/ public)	Number of Employees at your HP	Country of Practice

Type of TM used?

☐Remote Monitoring. ☐Interactive (Telephone/ Internet communications). ☐Store & Forward TM (eg: Evaluating Medical Images Offline). ☐Electronic Medical Record. ☐Live Video Consultation.

☐Educational. ☐Other, please specify:_____

For the next several questions, please choose a number from 1-5 for each statement to indicate how much do you agree with that statement.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	agree	Strongly Agree

Section B

2/ Service User Acceptance	Strongly Disagree	→			Strongly Agree
A) Patients will significantly benefit if TM was used in diagnosis.	1	2	3	4	5
B) Patients will significantly benefit if TM was used in treatment	1	2	3	4	5
C) Patients will significantly benefit if TM was used in follow up.	1	2	3	4	5
D) Patients will find TM easy to learn and use.	1	2	3	4	5
E) Less patient visits will be required if TM was used to provide H-care.	1	2	3	4	5

3/ Telemedicine (TM) Access	Strongly Disagree	→			Strongly Agree
A) Required telephone is easily available for the HP.	1	2	3	4	5
B) Required mobile handset with internet is easily available for HP.	1	2	3	4	5
C) Required internet access is easily available for the HP.	1	2	3	4	5
D) Required video conferencing is easily available for the HP.	1	2	3	4	5
E) Hardware required for the use of telemedicine is readily affordable	1	2	3	4	5
F) Software required for the use of telemedicine is readily affordable	1	2	3	4	5

4/ Healthcare Provider (HP) User Acceptance	Strongly Disagree	→			Strongly Agree
A) Using TM enables HP to complete patient care more quickly.	1	2	3	4	5
B) Using TM will improve patient care.	1	2	3	4	5
C) Using TM will improve patient management.	1	2	3	4	5
D) Using TM in patient care & patient management is a good idea.	1	2	3	4	5
E) Using TM will increase patient's access to healthcare.	1	2	3	4	5
F) TM technology will be easy to use.	1	2	3	4	5
G) TM technology will be clear & understandable.	1	2	3	4	5

5/ HP Learning Capability	Strongly Disagree	→			Strongly Agree
A) Learning to operate TM to provide healthcare will be easy	1	2	3	4	5
B) HP has past TM experience from pilot studies & their evaluation	1	2	3	4	5
C) Experiences provided by external sources are useful.	1	2	3	4	5

D) HP has the ability of utilizing external knowledge (eg: research centres).	1	2	3	4	5
E) HP has the ability in integration of external knowledge.	1	2	3	4	5

6/ HP Operational Capability	**Strongly Disagree**	→			**Strongly Agree**
A) If TM made available, you will have the necessary resources.	1	2	3	4	5
B) If TM made available, you will have the necessary knowledge.	1	2	3	4	5
C) If you have given the opportunities, resources & knowledge, it will aid your operations to utilizing TM.	1	2	3	4	5
D) TM will be compatible with your day to day working practices	1	2	3	4	5

7/ IT Infrastructure **In your opinion:**	**Strongly Disagree**	→			**Strongly Agree**
A) The technology needed for TM is available & ready to use.	1	2	3	4	5
B) The technology needed for TM is easy to maintain	1	2	3	4	5
C) Technical support is locally available to address any TM issues	1	2	3	4	5
D) Connection speed is appropriate for the use of TM to PH	1	2	3	4	5
E) Level of online security is appropriate for the use of TM to PH.	1	2	3	4	5

8/ HP Human Resources Management Capability	**Strongly Disagree**	→			**Strongly Agree**
A) HP personnel have the ability to work cooperatively in a team environment.	1	2	3	4	5
B) HP personnel have the ability to work closely with patients.	1	2	3	4	5
C) HP personnel are encouraged to learn new technologies.	1	2	3	4	5
D) HP personnel have various skills that relate to technology & its tools.	1	2	3	4	5
E) HP personnel closely follow the trends in current technologies.	1	2	3	4	5
F) HP personnel understand the legal issues using TM information.	1	2	3	4	5

Any further comment to add in section B?

Section C

9/ TM Outcome Expectations **Utilizing TM:**	Strongly Disagree	→			Strongly Agree
A) You will increase your effectiveness on the job.	1	2	3	4	5
B) You will spend less time on routine job tasks.	1	2	3	4	5
C) You will increase the quality of your job's output.	1	2	3	4	5
D) Will increase your job's productivities.	1	2	3	4	5
E) Will improve access to healthcare for more patients.	1	2	3	4	5
F) Improve your overall job performance.	1	2	3	4	5

10/ TM Readiness	Strongly Disagree	→			Strongly Agree
A) There will be comfort among staff members to use TM to PH.	1	2	3	4	5
B) There will be comfort among staff members using TM for educational purposes.	1	2	3	4	5
C) TM will be appropriate to the conditions within the organization.	1	2	3	4	5
D) Hardware & software are readily available for the proposed TM.	1	2	3	4	5
E) Hardware & software are readily affordable for the proposed TM.	1	2	3	4	5
F) HP personnel will be trained & ready to use TM.	1	2	3	4	5

11/ TM Adoption	Strongly Disagree	→			Strongly Agree
A) Using TM is beneficial to patient care and management.	1	2	3	4	5
B) Staff members are willing to use TM to PH if it was available.	1	2	3	4	5
C) Staff members are willing to use TM to PH as often as needed.	1	2	3	4	5
D) Looking forward to aspects of your job require the use of TM.	1	2	3	4	5
E) Using TM will make your work more interesting	1	2	3	4	5

Any further comment to add in Section C?

Thank you for assisting with this research

Appendix B: Ethical Approval Document

Cultural Attaché - London
Libyan Embassy

الملحقية الثقافية - لندن
سفارة ليبيا

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

10th June 2014

Confirmation Letter for Mr Ali Abdullrahim

To Whom It May Concern

This is to certify that the Cultural Attaché at the Libyan Embassy in London will have no objection to cooperate with Mr Ali Abdullrahim, PhD researcher at Brunel University, to conduct his study.

The Cultural Attaché will facilitate Mr Abdullrahim's access to the required data through contacting the group he is targeting for his study. That is, we will seek their consent and distribute them the questionnaires for the purpose of data collection.

This letter has been issued upon Mr Abdullrahim's request without any liability on our part.

If you require any further information, please do not hesitate to contact us.

Yours faithfully,

Dr. Abdelbasit Gadour
Cultural Attaché

61-62 Ennismore Gardens, London, SW7 1NH T: +44(0)20 3006 9891 F: +44(0)20 7584 6961 W: culturalaffairs.libyanembassy.org

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
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24 January 2019

LETTER OF APPROVAL

Applicant: Mr Ali Abdullrahim

Project Title: TM3

Reference: 15623-LR-Jan/2019- 17093-1

Dear Mr Ali Abdullrahim

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the stud
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor Hua Zhao

Chair

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London

Dear Sir/ Madam

This interview is part of my PhD Thesis at Brunel University London. It is designed to investigate telemedicine (TM) readiness at an organisational level in order to adopt and utilise TM technologies, such as tele-monitoring, in Libyan healthcare system for service provision focusing on chronic disease patients.

Your participation is voluntary and will contribute in survey success and it is appreciated. This semi-structured questionnaire will take approximately 20 to 30 minutes of your valuable time and the provided information will be confidential and used only for this research purpose.

A research ethics approval has been obtained from a relevant Research Ethics Committee and if you have any concerns or questions, please do not hesitate to contact me.

Ali Abdullrahim
Brunel University, London
College of Engineering, Design and Physical Sciences
Ali.abdullrahim@brunel.ac.uk

Participant Information Sheet

Title of Study: "Telemedicine Readiness in the Libyan Healthcare Sector "

You are being invited to take part in this study. Before you decide, it is important for you to understand why this research is being done and what it will involve. Please take your time to read the following information. If you have any question or would like additional information, please do not hesitate to ask the researcher, Ali Abdulbrahim at: ali.abdulbrahim@brunel.ac.uk

What is the purpose of this research study?

The researcher is interested to investigate Telemedicine (TM) Readiness at an organisational level in order to adopt and utilise TM technologies, such as Tele-monitoring, in Libyan healthcare system for service provision focusing on chronic disease patients.

Do I have to take part?

Participation is completely voluntary, and you can change your mind about taking part at any time. The participation for this study is one-off and there would be no subsequent follow up.

What I will be asked to do in this research?

You will be asked to take part in a validating interview which is in related to your views as a senior professional in the Libyan healthcare sector about Telemedicine Readiness in the Libyan Healthcare Sector.

What will happen to the results of the research study?

The results of the research study will form as a part of the researcher thesis document, and also will be published in journals and conference paper. The raw data will be anonymized and stored securely until destroyed.

Can I withdraw from the research?

If you feel at any time to withdraw from participating in this research, you may do so. Any information that may have been provided will be immediately destroyed.

Passage on Research Integrity

Brunel University, London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from our researcher during the course of their research. A research ethics approval has been obtained from the relevant Research Ethics Committee and any complains should be directed to the Chair of this Committee.

Contact details for further information:

Researcher details:

Name: Ali Abdulbrahim

E-mail: ali.abdulbrahim@brunel.ac.uk

Supervisor Details:

Name: Dr Rebecca DeCoster

E-mail: Rebecca.decoster@brunel.ac.uk

Brunel University London

PARTICIPANT CONSENT FORM

The participant should complete the whole of this sheet

Please tick the appropriate box

	YES	NO
Have you read the Research Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Have you received satisfactory answers to all your questions?	☐	☐
Who have you spoken to?		
Do you understand that you will not be referred to by name in any report concerning the study?	☐	☐
Do you understand that you are free to withdraw from the study:		
• at any time?	☐	☐
• without having to give a reason for withdrawing?	☐	☐
• (where relevant, adapt if necessary) without affecting your future care?	☐	☐
(Where relevant) I agree to my interview being recorded.	☐	☐
(Where relevant) I agree to the use of non-attributable direct quotes when the study is written up or published.	☐	☐
Do you agree to take part in this study?	☐	☐

Signature of Research Participant:

Date:

Name in capitals:

Witness statement

I am satisfied that the above-named has given informed consent.

Witnessed by:

Date:

Name in capitals:

Researcher name:	Signature:
Supervisor name:	Signature:

Appendix C: Result's Validation Questionnaire

Telemedicine Readiness in the Libyan Healthcare Sector

Job Role?

Number of years' experience in healthcare sector?

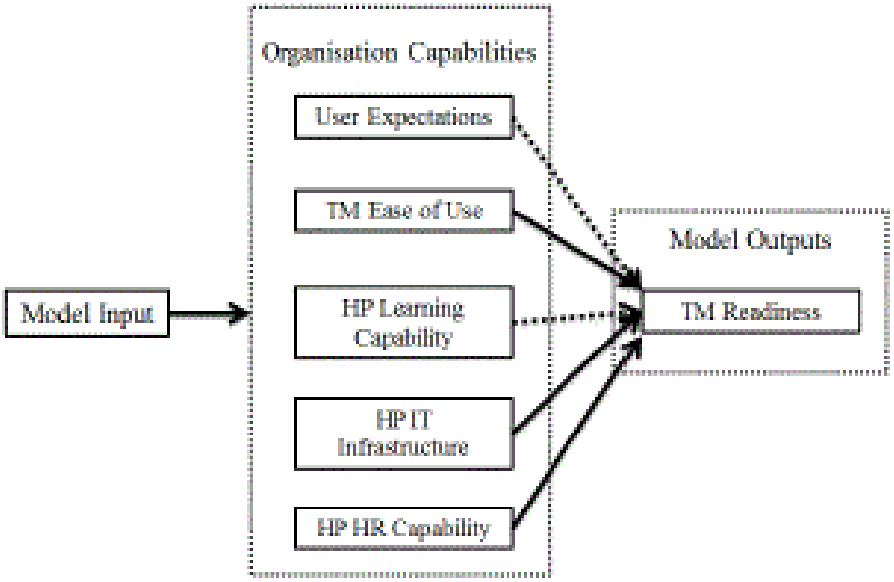
Q1. a/ Do you think the relationships within the attached framework are reasonable?

Yes…… No……..

b/ Please provide any comments regarding the structure, contents and design of this framework?

……

……



Key: TM = Telemedicine, HP = Healthcare Provider, HR = Human Resources

Significant impact ($p < 0.05$): ⟶

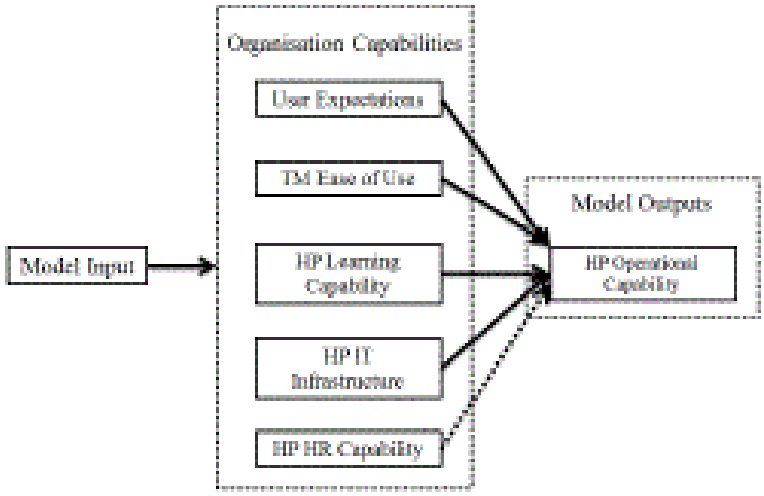
No significant impact: ($p > 0.05$): ⇢

Q2. What do you think, there were positive impacts between TM Ease of Use, IT Infrastructure and HP HR Capability with TM Readiness? But there was NO impact of User Expectation and HP Learning Capability on TM Readiness?

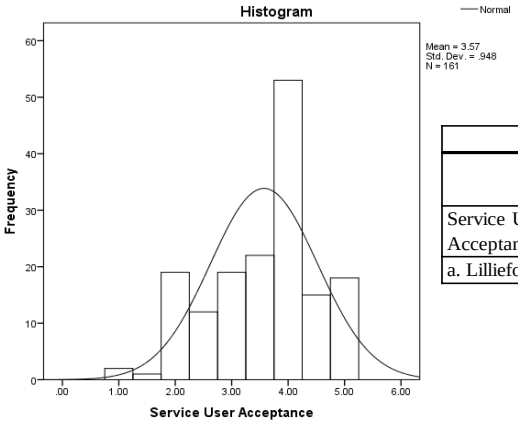
……

……

……

Q3.	What is your opinion on the following: There are positive relationships between HP Operational Capability, as another model output, and most of the Organisation Capabilities presented in the model below? But NOT with HP HR Capability? ....  Key: TM = Telemedicine, HP = Healthcare Provider, HR = Human Resources Significant impact ($p < 0.05$): ——→ No significant impact: ($p > 0.05$): ·····→
Q4.	What do you think, there were positive impacts of HP User Expectation and HP HR Capability with TM Outcome Expectation presented as another Model Output? But there was NO impact of TM Ease of Use, HP Learning Capability and IT Infrastructure on TM Outcome Expectation? ....
Q5.	In your opinion, what is the impact those frameworks could have on the healthcare service provision such as chronic disease patient management? ....
Q6.	Any other comments you would like to add? ....

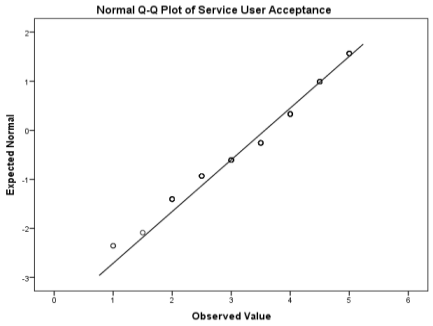
Appendix D: Normality Plots

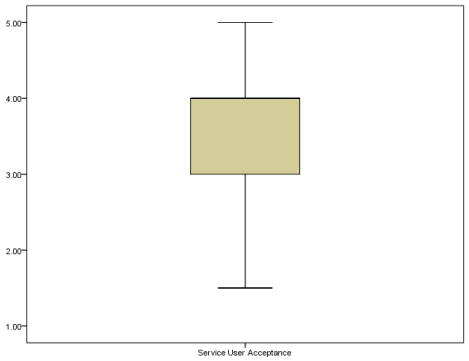


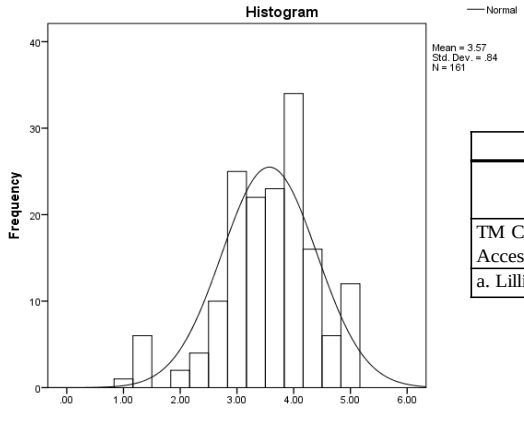
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Service User Acceptance	.208	161	.000	.926	161	.000

a. Lilliefors Significance Correction



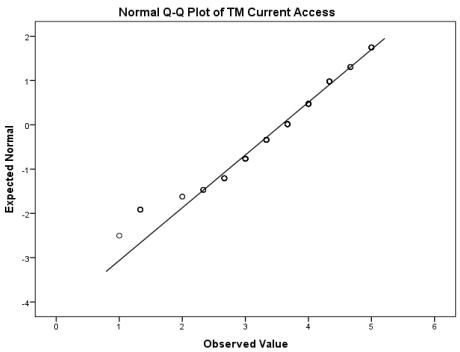


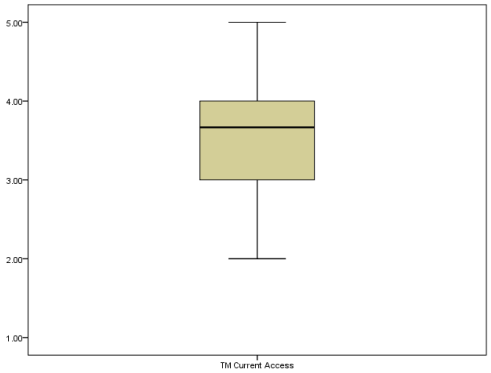


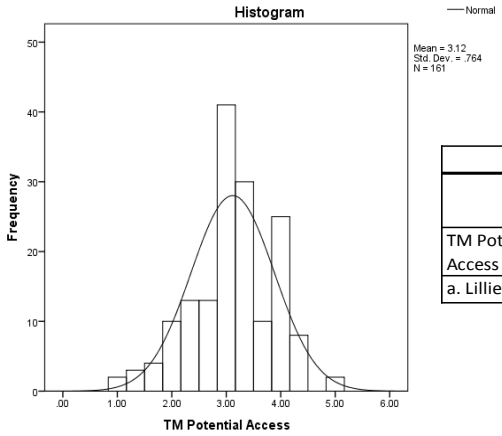
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TM Current Access	.118	161	.000	.946	161	.000

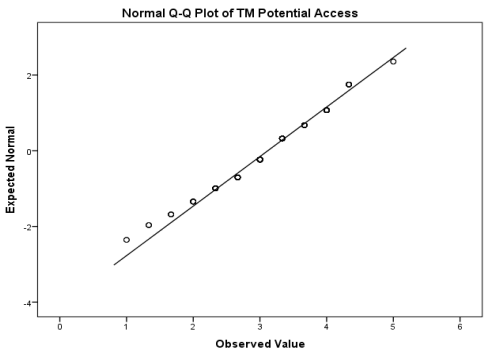
a. Lilliefors Significance Correction

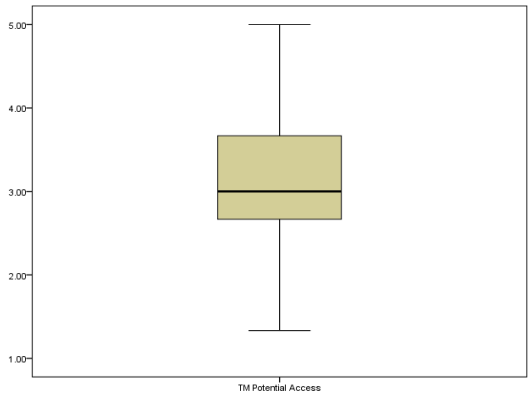


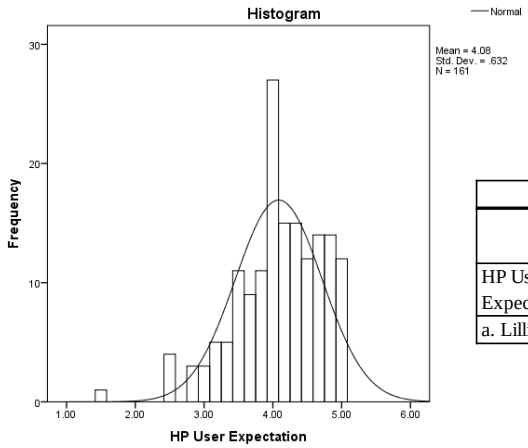




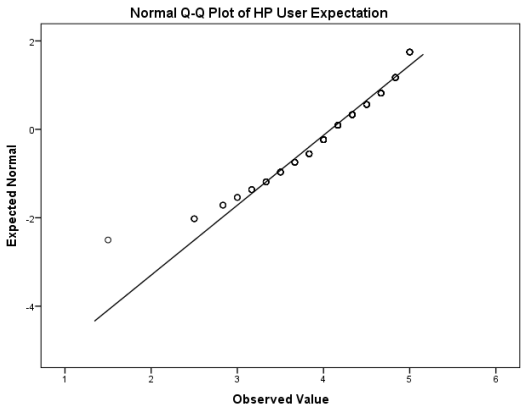
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TM Potential Access	.159	161	.000	.964	161	.000
a. Lilliefors Significance Correction						

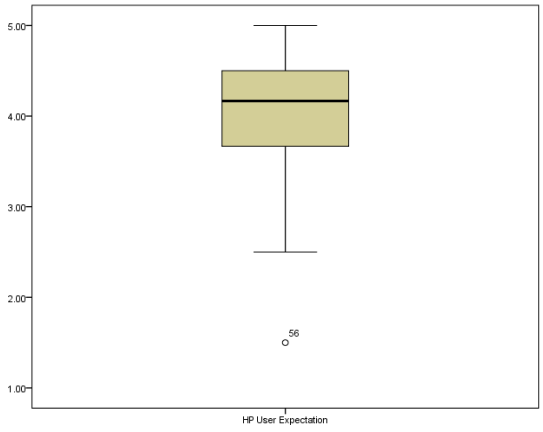


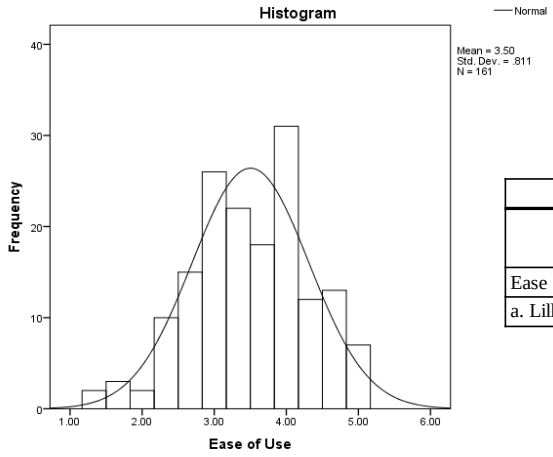




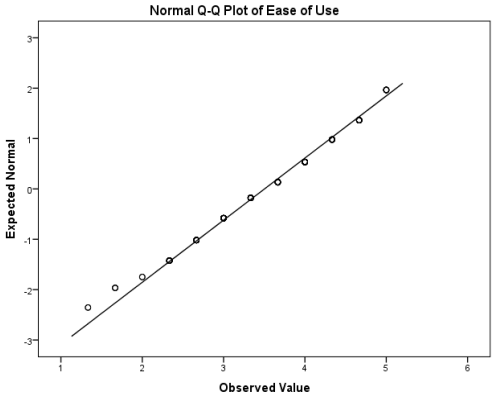
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HP User Expectation	.124	161	.000	.946	161	.000
a. Lilliefors Significance Correction						

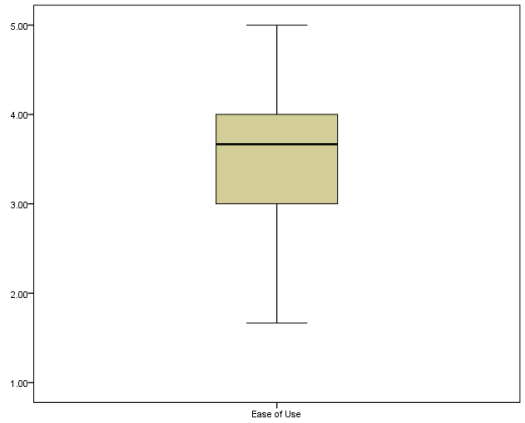


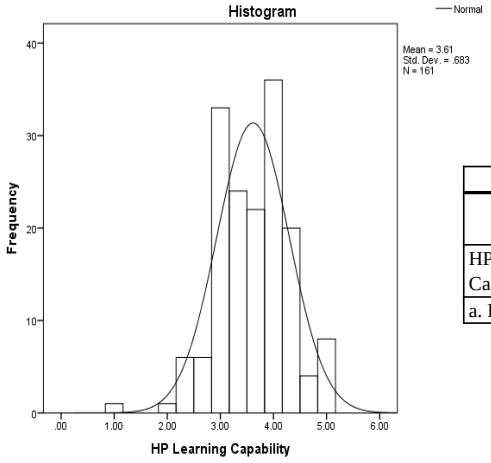




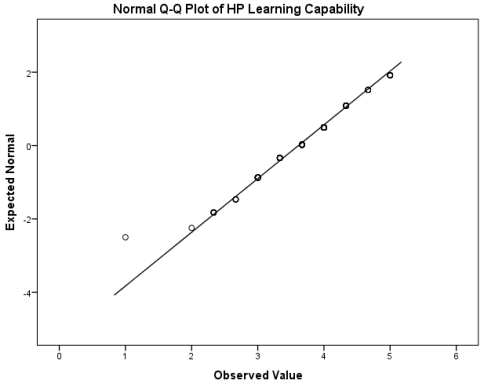
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Ease of Use	.121	161	.000	.972	161	.002
a. Lilliefors Significance Correction						

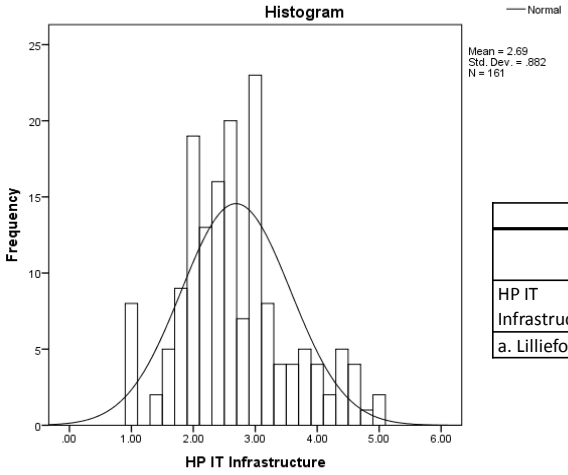




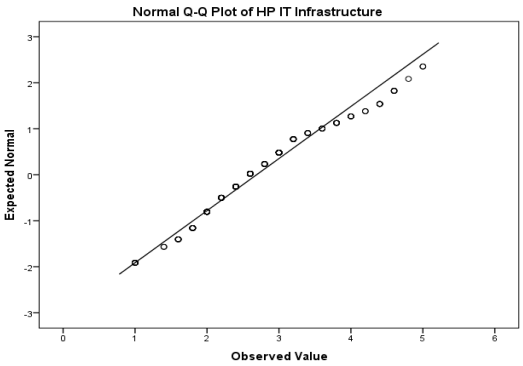


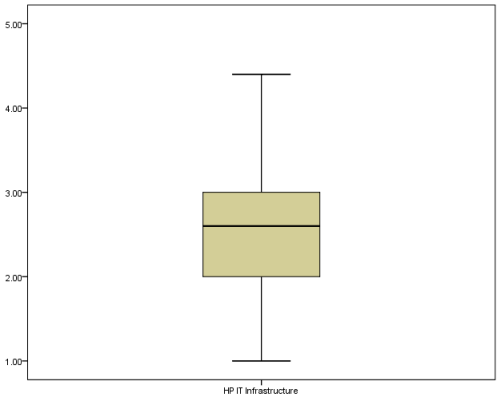
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HP Learning Capability	.136	161	.000	.959	161	.000
a. Lilliefors Significance Correction						

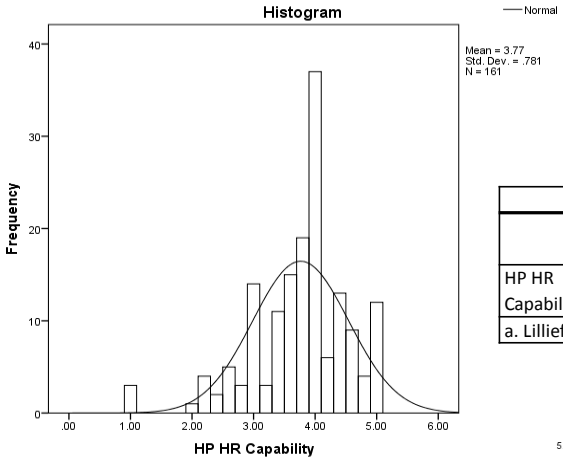




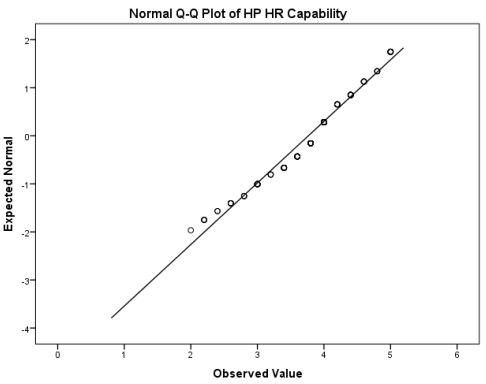
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HP IT Infrastructure	.120	161	.000	.964	161	.000
a. Lilliefors Significance Correction						

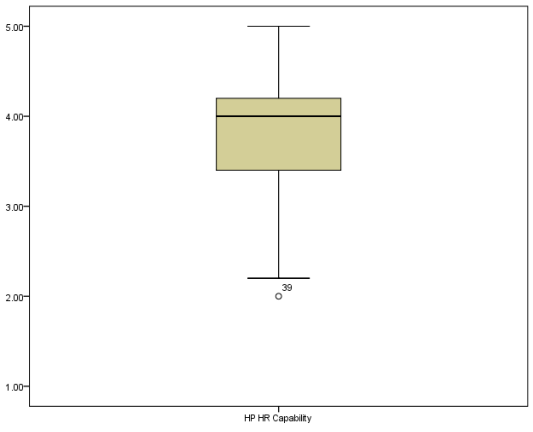


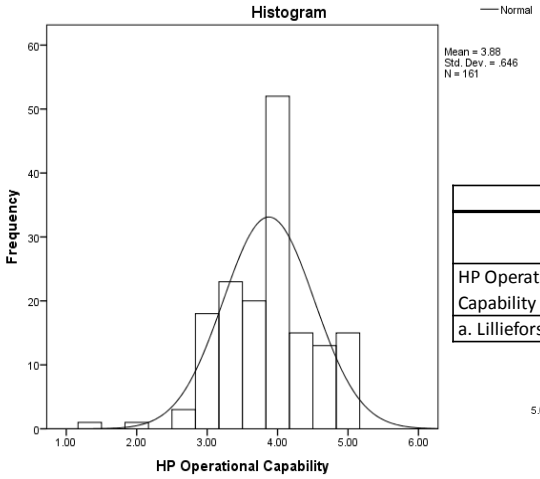




Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HP HR Capability	.139	161	.000	.932	161	.000
a. Lilliefors Significance Correction						



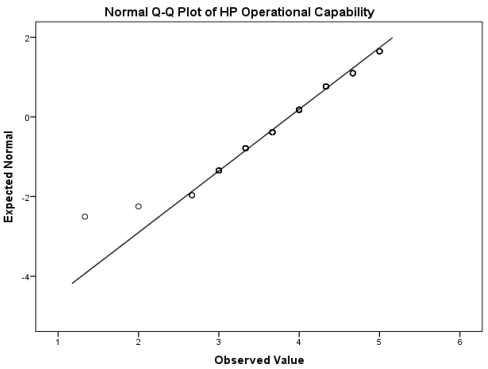


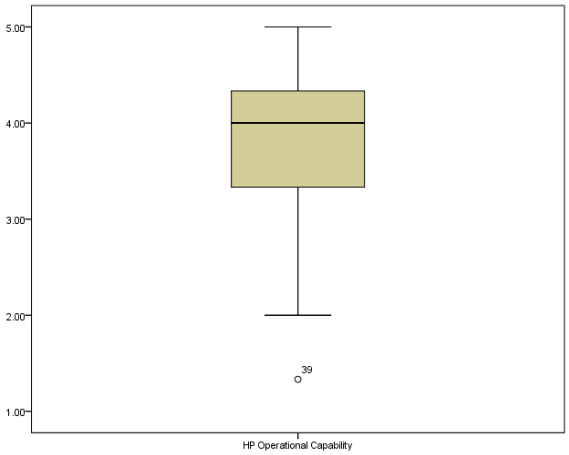


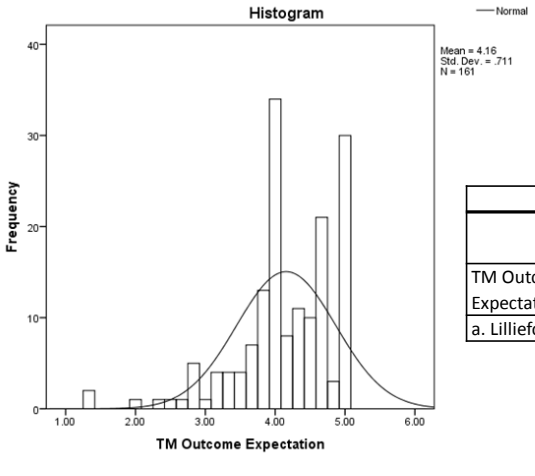
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HP Operational Capability	.166	161	.000	.943	161	.000

a. Lilliefors Significance Correction



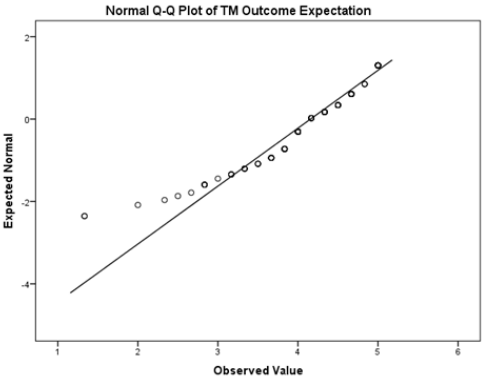


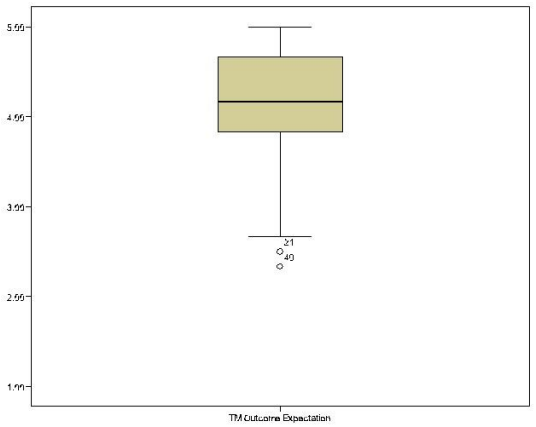


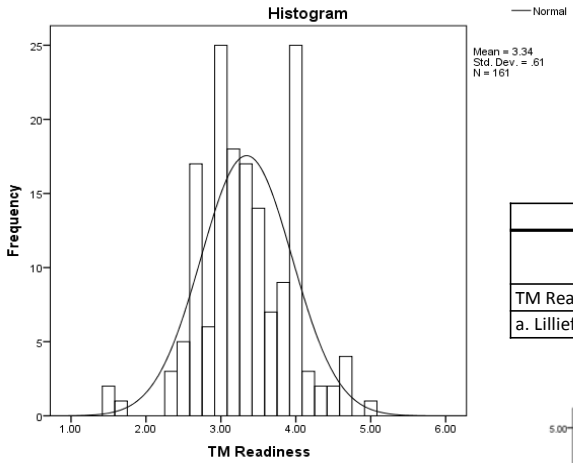
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TM Outcome Expectation	.139	161	.000	.894	161	.000

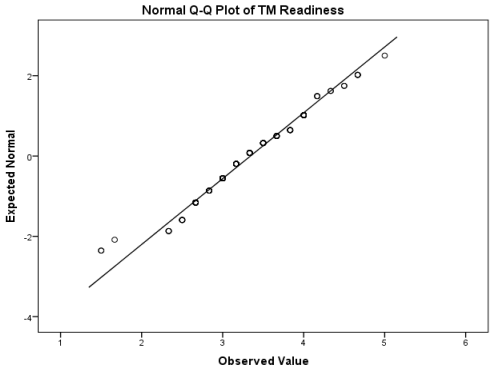
a. Lilliefors Significance Correction

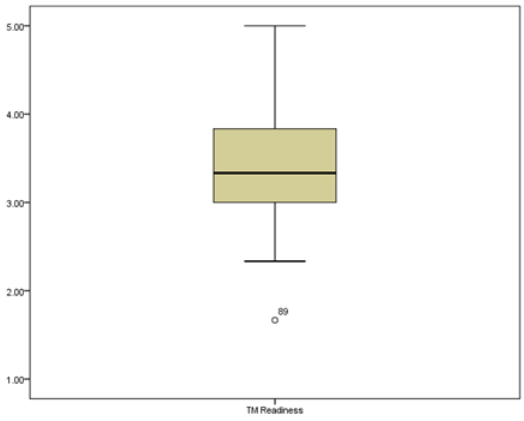


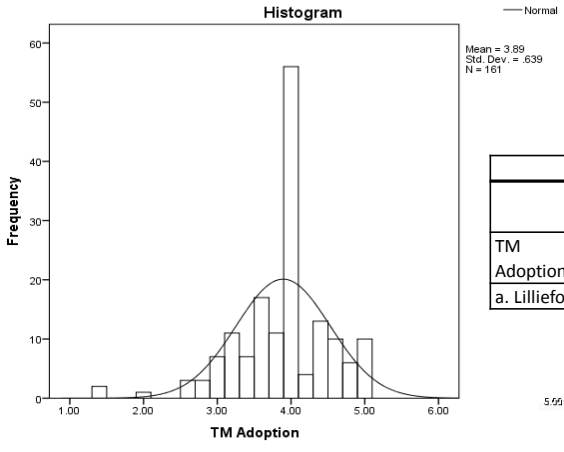




Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TM Readiness	.092	161	.002	.972	161	.002
a. Lilliefors Significance Correction						







Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TM Adoption	.181	161	.000	.927	161	.000
a. Lilliefors Significance Correction