A COMPARATIVE FIELD STUDY IN FOUR EMERGING MARKETS; TURKEY, KINGDOM OF SAUDI ARABIA, UNITED ARAB EMIRATES AND EGYPT ON E-HEALTH DEVELOPMENT CHALLENGES AND EXPECTED UTILIZATION CAPABILITIES

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Abstract

The implementation and utilization of e-health in the healthcare sector has great potential to improve healthcare practices in general. The use of e-health becomes increasingly crucial for developing countries, that are confronted with many problems in healthcare and medical services such as; access, financial needs, limitations in resources and competent healthcare professionals.

Even with these types of efficiencies that e-health would bring to the healthcare system, which are likely to be accepted by many healthcare stakeholders, there is still no consensus among healthcare professionals, government decision-makers and the users such as doctors, hospital staff, and patients for implementation and utilization. Furthermore, even if e-health can improve healthcare decision-making both for healthcare providers and patients, as well as providing speed and accuracy of information upon which healthcare decisions are made, there are still challenges surrounding investment and implementation decisions. These challenges become more significant in emerging countries where governments have initiatives for e-health implementation and utilization.

This field study presents an original contribution to knowledge, by evaluating e-health challenges and needs for development and utilization of e-health and its possible adaption capabilities in four selected emerging countries; Turkey, Kingdom of Saudi Arabia, United Arab Emirates and Egypt, based on user insights.

This research constitutes a distinctive approach by comparing the similarities and differences across those selected countries regarding their e-health implementation practices. The study also puts forward a new framework of a solution model to existing challenges for an impactful development of e-health facilities in those

markets. This unique model is based on the outcomes of the field survey and face to face interviews conducted with authorities of health ministries and healthcare professionals in selected countries.

The results of this research, emphasize significant contribution of information communication technology infrastructure readiness, and governmental regulations in a country for e-health development and implementation. The study also shows that as the level of trust to electronic applications for healthcare increases, e-health development and implementation will increase.

Another result is the requirement of cultural adaptation of related e-health stakeholders such as clinicians, healthcare professionals and patients for an impactful e-health development. This research also guides in understanding the positive effects of financing and supply chain management, on e-health development and implementation in that selected country, based on user insights.

This study is an inventive comparative evaluation of user perspectives by analyzing clinicians' views versus information technology healthcare professionals' views, on expected positive outcomes of e-health for the country.

This research study also presents a genuine user foresight for healthcare e-commerce approach and buying criteria of users, providing guidance for the healthcare industry.

Key Words: E-health, User Insights, Emerging Markets, E-health Development Model

YÜKSELEN DÖRT ÜLKEDE; TÜRKİYE, SUUDİ ARABİSTAN KRALLIĞI, BİRLEŞİK ARAP EMİRLİKLERİ VE MISIR, E-SAĞLIK GELİŞİM ZORLUKLARI VE BEKLENEN KULLANIM YETKİNLİKLERİNİN MUKAYESELİ SAHA ÇALIŞMASI

Özet

Sağlık sektöründe, e-sağlık kurulum ve kullanımı, genel olarak sağlık uygulamalarının gelişmesinde büyük bir potansiyele sahiptir.

E-sağlık kullanımı, erişim, finansman ihtiyacı, kaynak kısıtlılığı ve yetkin sağlık profesyonellerinin eksikliği nedeniyle, sağlık ve medikal hizmetlerde pekçok zorluk yaşanan, gelişmekte olan ülkelerde daha çok önem kazanmaktadır.

Her ne kadar e-sağlığın sağlık sistemine getireceği bu etkinlikler pekçok sağlık paydaşı tarafından kabul görse de, halen sağlık profesyonelleri, hükümet yetkilileri, doktorlar, sağlık çalışanları ve hastalar gibi kullanıcılar arasında e-sağlık kurulum ve kullanımı için bir fikir birliği bulunmamaktadır.

Ayrıca e-sağlık, sağlık tedarikçileri ve hastalar için, sağlıkta alınan kararlarda iyileştirme, hız ve enformasyon doğruluğu sağlasa da, e-sağlık yatırım ve kurulum kararlarında halen zorluklar bulunmaktadır.

Bu zorluklar e-sağlık kurulum ve kullanımı için devlet girişimleri olan yükselen ülkelerde daha çok öne çıkmaktadır. Bu saha çalışması, seçilen dört yükselen ülkede; Türkiye, Suudi Arabistan Krallığı, Birleşik Arap Emirliği ve Mısır'da, e-sağlık kullanım ve gelişim zorlukları ile olası adaptasyon yetkinliklerini, kullanıcı görüşleriyle değerlendirerek bilgiye özgün katkı sunmaktadır.

Bu araştırma, seçilmiş ülkeler arasında, e-sağlık uygulamalarının benzerlik ve farklılıklarını karşılaştırarak orijinal bir yaklaşım göstermektedir. Çalışma aynı zamanda, bu pazarlarda e-sağlık donanımlarının etkin gelişimi için mevcut zorluklara yeni bir çözüm modeli ortaya koymaktadır.

Bu özgün model, seçilmiş olan ülkelerde Sağlık Bakanlığı yetkilileri ve sağlık profesyonelleriyle yapılan saha araştırması ve yüz yüze görüşmelerin neticelerine dayandırılmıştır.

Araştımanın sonuçları o ülkedeki e-sağlık gelişimi ve kurulumunda bilişim teknolojileri altyapısının hazırlığı ve regülasyonların önemini vurgulamaktadır. Bu çalışma, aynı zamanda sağlıkta elektronik uygulamalara güven seviyesi arttıkça e-sağlık gelişimi ve kurulumunun artacağını göstermektedir. Bir diğer sonuç, klinisyenler, sağlık profesyonelleri ve hastalar gibi e-sağlık paydaşlarının, etkin e-sağlık gelişiminde, kültürel adaptasyonunun gerekliliğidir.

Bu araştırma, seçilmiş olan ülkelerde, hasta görüşleri doğrultusunda, finansman ve tedarik zinciri yönetiminin, e-sağlık gelişim ve kurulumunda pozitif etkilerini anlamak bakımından önemli veriler sunmaktadır.

Bu çalışma, klinisyenler ve bilişim teknolojileri sağlık profesyonellerinin e-sağlığın ülke için beklenen pozitif katkılarına dair mukayeseli görüşlerinin orijinal bir değerlendirmesidir.

Bu araştırma, sağlıkta e-ticarete yaklaşım ve müşteri satın alma kriterlerlerini, özgün müşteri öngörüleriyle irdelemektedir.

Anahtar Kelimeler: E-Sağlık, Kullanıcı Öngörüleri, Yükselen Pazarlar, E-Sağlık Gelişim Modeli

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List of Abbreviations

AMIA	American Medical Informatics Association
B2B	Business to Business
B2C	Business to Consumer
CHI	Consumer Health Informatics
CDS	Clinical Decision Support
CPOE	Clinical Computerized Physician Order Entry
CT	Clinical Terminology
DICOM	Digital Imaging and Communications in Medicine
D2D	Doctor to Doctor
DHA	Dubai Health Authority
E-commerce	Electronic Commerce
EIPAHA	European Innovation Partnership on Active and Healthy Ageing
EHR	Electronical Health Record
EMR	Electronic Medical Record
E-procurement	Electronic Procurement
FMIS	Family Medicine Information System
FTSE	Financial Times Stock Exchange
HAAD	Abu Dhabi Health Authority
HCIT	Healthcare Information Technology
HCP	Healthcare Professional
HIE	Health Information Exchange
HIMMS	Healthcare Information and Management Systems Society
HIT	Health Information Technology
IDC	International Data Cooperation
ICT	Information and Communicatıon Technologies
KSA	Kingdom of Saudi Arabia
LMIC	Low Middle Income Countries

MDDS	Medical Decision Support System
M-Health	Mobile Health
MSCI	Morgen Stanley Capital International
NHS	National Health System
NHR	National Health Record
NHII	National Health Information Infrastructure
PDA	Personal Digital Assistant
PHR	Personal Health Record
P2D	Patient to Doctor
SAHI	Saudi Association for Health Information
SWD	Staff Working Document
TM	Tele Medicine
UAE	United Arab Emirates
WHO	World Health Organization

To my treasure, Zeynep

CHAPTER 1

CORE CONCEPTS OF E-HEALTH

1.1 Digital Technologies in Healthcare; Future Trends and Challenges

Innovation and new technology adoption are crucial for better and faster outcomes in healthcare. In that respect technology has great potential to improve the quality and safety of healthcare. This makes the utilization of the information technology for healthcare and healthcare related services meaningful.

Looking at developments of technology for healthcare, it can be understood that many technologies evolve for healthcare over time. Some of them have either little or no impact today whereas some technologies may progress more rapidly from development to discovery impacting on patient healthcare. The Deloitte Healthcare and Life Sciences Predictions Report analyzes healthcare trends for the future, which predicts that, informed and demanding patients will be partners in their own healthcare as well as the era to be more of digitalized medicine with new business models by 2020 (Deloitte, 2015a, p.4).

The rising demand and costs of healthcare, the need for more of qualified healthcare professionals, global technology requirements for faster and more accurate diagnostic and treatment outcomes, challenges of accessability to rural areas encourage more use of digital technologies to improve and provide a more efficient healthcare service management (Deloitte,2015a). In that respect, e-health related practices are expected to affect those healthcare services and outcomes positively by contributing to the effectiveness and the efficiency of the overall healthcare ecosystem.

The study of Elbert et al. (2014, para 5) states that, the assessments on e-health interventions in patients with physical illnesses has expanded considerably in latter years and most of this related research indicates that e-health is cost-effective.

E-health with its broadest definition, refers to the use of information technologies in healthcare services. E-health as a concept is a very broad one and acts as an umbrella to cover many related sub-concepts within its content such as m-health (mobile health), tele-health, telemedicine, and healthcare e-commerce. Today, healthcare systems note the value of existing and new data sources such as electronic health records, patient provided data creating governance to allow data access and sharing, form data partnerships and change on how care is delivered on the basis of data insights (Deloitte, 2015c, p.5).

The wearables and m-health applications are expected to have a crucial role for healthcare in the future as measuring quality of life will have more significance than only measuring clinical indicators. Consumers and providers integrate information from multiple devices smoothly to create a comprehensive view of the individual. The new clinician/patient partnership is based on improved awareness, self management and prevention strategies, replacing the conventional approach *(ibid).*

According to the Deloitte Government 2020 report (Deloitte, 2015b), two words best describe the future health care trend: healthcare, everywhere. Mobile health applications, telemedicine, m-health, remote monitoring, and ingestible sensors produce rich streams of data, allowing clinicians and patients themselves to track every heartbeat, sneeze or symptom in real time *(ibid).*

The trend in healthcare is aimed towards more use of information technology handling healthcare data, decision support softwares for the clinicians, virtual hospital environments and availabilities for remote care. The expected growth is use for smartphone healthcare applications, point of care, lab on a chip technologies and tendency towards more of personalized medicine. It encourages tailor made technology rather than a one size fits all approach by lab on a chip turning smart phones into mobile disease clinics (Weiler, 2015, para.1). In many servicing and industrial fields, ICT (Information Communication Technologies) has been applied due to complications in the fields of health and treatment. On the other hand, effectiveness of electronic services has always been under question. ICTs are potentially powerful instruments to strengthen health systems with innovations ranging from electronic health records to transmission of clinical data (Hossein, 2012, p.49).

These technologies show great promise in low and middle income countries (LMICs) whose health systems face severe financial, infrastructural, technical and human resource constraints. This is evident in the growing number of health service providers beginning to focus on mobile technologies to improve access and quality of health services (Schweitzer and Synowiec, 2012, p.74). Even if the trend in healthcare is becoming more aimed towards digital health, building a digital infrastructure is not easy. There are some major pillars such as technology infrastructure, know-how and regulations. Today it is also recognized that patient privacy is one of the major concerns for e-health.

In that respect handling healthcare data becomes particularly crucial. One of the key challenges is with the proper and integrated implementation of information technology towards 2020 for the healthcare sector. The internationally recognized interoperability standards emerge, which consecutively enable the adaptation of electronic health records integrated. This is still one of the key area that requires improvement (Deloitte, 2015c).

There are great innovations and trends surrounding digital health that are making a significant impact on e-health. Traceability systems support document activities along the patient pathway. Decision Support Softwares will help doctors conforming them to best practices as the volume of information escalates actively; medical decision- support systems (MDDS) are computer systems designed to guide physicians or other healthcare professionals in making clinical decisions (Conejar and Kim, 2014, p.237).

'Virtual Hospital Environments' with patients and professional advocates are used to improve clinical skills through the use of teamwork. New advances on Web technologies provide powerful tools for online information retrieval. This provides a possibility to extend the services of e-health by enabling patients, patients' famililies and the community at large to participate more actively in the process of health education (Anshari, 2012, p.1). Those new beneficial technologies mentioned above, materialized in different parts of the world mostly in advanced countries and in highly developed hospitals. On the other hand the challenges of full integration and smooth operation still remain. Today it is known that even if some developed countries have better implementation and utilization of e-health, there are many developing countries that are confronted with challenges, mainly due to lack

of regulations and technological infrastructure. 'Developing Countries' are experiencing many problems in the healthcare and medical services such as financial needs, resources, proficiency and lack of physicians and other healthcare professionals (Khalifehsoltani and Gerami, 2010, p.264).

Governmental initiatives to finance, prioritize and encourage digital technologies in healthcare are other challenges impacting the growth and the implementation of the whole process of e-health in a country.

Clinical cultural adaptation of related e-health stakeholders such as doctors, nurses and other healthcare professionals is also critical in the roadmap of e-health implementation impacting the outcomes and success. According to Doktor (2005), when introducing a new technology that changes the core processes of an organization, such as an e-health initiative, it is important that the structural design and culture of the organization is aligned with the predominant national culture in which the organization is entrenched. The literature survey reflects that there is still limited research study in the arena of e-health especially in the developing countries to describe the major challenges for implementation and probable outcomes of utilization.

This original field study evaluates the major challenges and expected outcomes of e-health utilization in selected emerging markets based on user insights. This study also presents e-health practices and its possible adaption capabilities in four selected emerging countries; Turkey, Kingdom of Saudi Arabia, United Arab Emirates and Egypt with a new framework of a solution model.

The next sections explore core concepts of e-health, evaluate pros and cons and bring insights for global initiatives. Further, in chapter 3 the governmental e-health efforts in Turkey, Kingdom of Saudi Arabia, United Arab Emirates and Egypt are presented. Turkey and Kingdom of Saudi Arabia are more advanced with the implementation whereas UAE and Egypt are more at the initial stages.

1.2 Definition of E-health

E-health is a broad concept where various definitions are found in literature. In general terms, e-health is the use of information and communications technologies in healthcare.

A still valid and referred definition is from Eysenbach. In his article, Eysenbach (2001, para.3) defines e-health as an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or improved through the internet and related technologies. Eysenbach (2001) mentions that e-health in a broader sense, indicates not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology. Eysenbach (2001) in his article also states that even e-health as a term was rarely in use before 1999. E-health then started being used to define not only "internet medicine", but also practically everything related to computers and medicine *(ibid)*. The term was first used by industry leaders and marketers rather than academics. The industry leaders and marketers created and used this term in line with other "e-words" such as e-commerce, e-business, e-solutions, and so on, in an attempt to explain the promises, principles, excitement (and hype) around e-commerce (electronic commerce) to the health arena, and to describe the new possibilities the internet is opening up to the area of health care (Raman and Tewari, 2012). According to Raman and Tewari (2012, p.33), Intel for example defines e-health as 'a coordinated effort undertaken by leaders in health care and hi-tech industries to fully utilize the benefits available through the merge of the internet and health care'.

As the internet created new opportunities and challenges to the traditional health care information technology industry, the use of a new term to address these issues seemed appropriate. These 'new' challenges for the health care information technology industry were mainly:

(1) the capability of consumers to interact with their systems online (B2C = 'business to consumer');

(2) improved possibilities for institution-to institution transmissions of data (B2B = 'business to business');

(3) new possibilities for peer-to-peer communication of consumers (C2C = 'consumer to consumer') *(ibid*).

Liezl van Dyk, (2014, p.1279) in his article, published in journal of Enviromental Research Public Health, adopted the WHO (2005) e-health definition in his article as 'the cost-effective and secure use of ICT in support of health and health related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research'.

Today even if there is a defined and agreed content by many researchers and industry experts, there are still overlaps and outliers of the concepts to define the full framework of the definition and scope of e-health. There are many studies in literature where terminologies like telemedicine, tele-health, e-health and even health e-commerce being referred in an interchangeable fashion.

In that respect, Liezl van Dyk (2014, p.1280) claims that the terms e-health and tele-health are most often used in an identical manner. On the other hand, the difference between these two concepts is that e-health applications are not limited to healthcare over a distance, as is the case with tele-health.

There are other studies in literature referring to tele-health. Bashshur et al. (2011, p.487), explain that tele-health relates to telemedicine the same way that health relates to medicine. Sood et al. (2007), after revising 104 peer-reviewed definitions for telemedicine, concluded that telemedicine is a subset of tele-health. According to Bashshur et al. (2011), Bennet et al.(1978) used the term tele-health to extend the scope of telemedicine by incorporating a wider set of activities, including patient and provider education.

Telemedicine, a term originated in the 1970s, which literally means "healing at a distance" (Strehle and Shabde, 2006, p.956), signifies the use of information communication technologies (ICT) to improve patient outcomes by increasing access to care and medical information.

Recognizing that there is no one definitive definition of telemedicine, the World Health Organization (WHO) has adopted the following broad description for telemedicine; 'The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing

education of health care providers, all in the interests of advancing the health of individuals and their communities' (WHO, 1998, p.10).

According to the WHO (1998) report, many definitions highlight that telemedicine is an open and constantly evolving science, as it incorporates new advancements in technology, as well as responds and adapts to the changing health needs and contexts of societies. Some distinguish telemedicine from tele-health with the former restricted to service delivery by physicians only, and the latter signifying services provided by health professionals in general, including nurses, pharmacists, and others. The WHO (2010a, p.8-9) report mentions that telemedicine and tele-health are synonymous and are used interchangeably. There are four elements that are critical to telemedicine:

1. Its purpose is to provide clinical support.

2. It is intended to overcome geographical barriers, connecting users who are not in the same physical location.

3. It involves the use of various types of ICT.

4. Its goal is to improve health outcomes *(ibid)*.

Telemedicine is a subset of tele-health. Tele-health is an expansion of telemedicine, but unlike telemedicine, which has a narrower focus on the curative aspect, it encircles the preventative, promotive, as well as the curative aspects of the field (Bashshur et al.2011; Sood et al. 2007).

Within the scope of e-health, it can be noticed that mobile health (m-health) is referred as a subsegment. M-health is another concept, appeared relatively recently in the literature on e-health. M-health refers to e-health applications that are accomplished with the help of mobile technology (Dyk, 2014, p.1281).

The figure below, presented by Liezl Van Dyk (2014) in his article 'a Review of Telehealth Service Implementation Frameworks', guides for a better understanding of concepts around e-health;

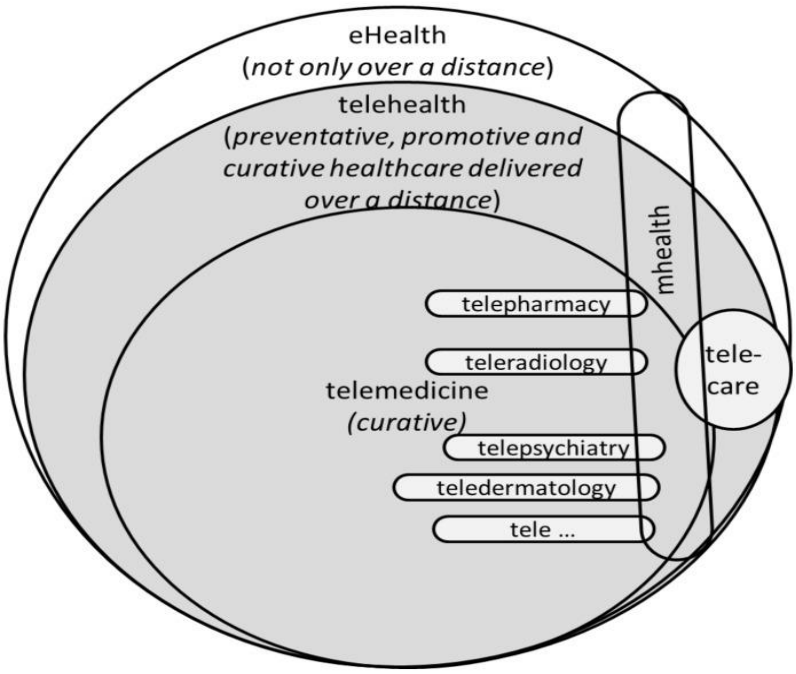


Figure 1.1 Telemedicine, E-health, Tele-health, Telecare and M-health (Dyk, L.V., 2014 p. 1282)

In the scope of this study mainly the WHO definitions are taken as reference. One of the latest and recent definitions from WHO in the glossary report for trade, foreign policy, diplomacy and health defines e-health as the transfer of health resources and health care by electronic means (WHO, 2016, p.2). The report mentions that e-health includes the following three main areas:

- The delivery of health information, for health professionals and health consumers, through the internet and telecommunications.
- Using the power of IT and e-commerce to improve public health services, as an example through the education and training of health workers.
- The use of e-commerce and e-business practices in health systems management.

E-health provides a new method for using health resources such as information, money, and medicines and in time should help to improve efficient use of these resources. The Internet also contributes to a new medium for information circulation, and for interaction and collaboration among institutions, health professionals, health providers and the public (WHO, 2016).

According to the WHO Report (WHO, 2016), e-commerce is referred as the production, distribution, marketing, sale or delivery of goods and services by

electronic means. An example of this is conducting business over the internet. The reduced costs, the amount of information available and the speed of doing business on-line are creating a revolution in the way that business is conducted. The same report mentions that tele-health includes surveillance, health promotion and public health functions. Tele-health is broader in definition than tele-medicine as it includes computer-assisted telecommunications to support management, surveillance, literature and access to medical knowledge. Tele-medicine is the use of telecommunications to diagnose and treat disease and ill-health. Telematics for health is a WHO composite term for both tele-medicine and tele-health, or any health related activities carried out over distance by means of information communication technologies (WHO, 2016, p.2). The European Commission 'E-health Policy Report' (European Commission, 2016, p.9), defines e-health as the use of modern information and communication technologies to meet needs of citizens, patients, healthcare professionals, healthcare providers, as well as policy makers. This report refers to tools and services using information and communication technologies (ICTs) that can improve prevention, diagnosis, treatment, monitoring and management. E-health can benefit the entire community by improving access to care and quality of care by making the health sector more efficient. Further it includes information and data sharing between patients and health service providers, hospitals, health professionals and health information networks; electronic health records; telemedicine services; portable patient-monitoring devices, operating room scheduling software, robotized surgery and research on the virtual physiological human *(ibid)*.

E-health emerged early in the 21st century and is an all-encircling term for the combined use of electronic information and communication technology in the health sector (Harrison et al.,2006, p.283). This term refers to certain technologies used for clinical, educational, research, and administrative purposes, both at the local site and across wide geographic regions. The use of e-health has increased networking, encouraged global thinking, and improved health care on local, regional, and national levels (Cashen et al., 2004).

The studies of Cashen et al.,(2004); Deluca and Enmark (2000); Kind et al., (2004); and Kwankam (2004), mention that, the term e-health broadly refers to any

electronic exchange of health-related data collected or analyzed through an electronic connectivity for improving efficiency and effectiveness of health care delivery. Therefore, it is often used to describe basically everything related to computers and medicine.

Hence, within the scope of this study e-health is the blanket term to cover mainly the topics below acting as the main concept of digital and connected health for healthcare business:

- Electronic Medical Records (EMR) /Electronic Health Records (EHR)
- Tele-health and its subsegment telemedicine
- Health Information Technology (HIT) systems
- Consumer health IT data
- Mobile Health (m-health)
- Big data systems used in digital health
- Healthcare e-commerce

The electronic health record (EHR) is an emerging concept defined as a continuous collection of electronic health information about individual patients and populations (Gunter and Terry, 2005, para.2). Primarily, it will be a mechanism for integrating health care information currently collected in both paper and electronic medical records (EMR) for the purpose of improving quality of care. Although EHR is a wide-area, cross-institutional, even national construct, the electronic records landscape also includes some distributed, personal, non-institutional models *(ibid)*. The electronic health records (EHR) and electronic medical records (EMR) essentially cover patient records, e-prescribing, clinical administration systems, e-registration or e-bookings, digital imaging and archiving systems. Reid et al. (2005, chapter 2), state that EHRs are the infrastructure for a well structured, regulated, interoperable electronic national health records (ENHR). According to Reid et al., electronic national health records are crucial for entire e-health structure and to build that, firstly a national health information infrastructure must be developed *(ibid)*.

The national health information infrastructure (NHII) is defined as ‘a set of technologies, standards, applications, systems, values, and regulations that support all aspects of individual health, health care, and public health’ (Reid et al., 2005). It

covers an information network based on internet protocols, common standards, timely knowledge transfer, and transparent government processes with the capability for information flows across three dimensions:

(1) personal health, to support individuals in their own wellness and health care decision making;

(2) health care providers, to ensure access to complete and accurate patient data around the clock and to clinical decision support systems; and

(3) public health, to address and track public health concerns and health education campaigns (Reid et al., 2005).

Another term that is referred within the vast e-health scope is the health information technology (HIT). As referred in the US governmental health and resource public website, health information technology (HIT) is defined as 'the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making' (USA Department of Human Resources, 2016). Applications of health IT include the electronic health record (EHR), the personal health record (PHR), computerized physician order entry (CPOE), and clinical decision support (CDS). In addition, health information exchanges (HIEs) are being developed to support sharing of information electronically among health care providers *(ibid)*.

Another significant contributor to e-health is consumer health informatics (CHI), which is an emerging field that utilizes technology to provide health information in order to enhance health-care decision making by the public. Consumer informatics applications include thousands of health-oriented websites and hundreds of thousands of mobile health applications that are becoming increasingly popular (USA Department of Human Resources, 2016). Within the big scope of e-health, it is important to note the essence of clinical health informatics. According to 'The American Medical Informatics Association' (AMIA), clinical health informatics is the field where clinical informaticians transform health care by analyzing, designing, implementing, and evaluating information and communication systems that enhance individual and population health outcomes, improve patient care, and strengthen the clinician-patient relationship (Gardner, 2009, P.153). Clinical health

IT systems refer to such as radiology, nursing health IT systems, computer-assisted diagnostics, medical imaging, and surgery training and planning systems that help physicians to provide more accurate diagnoses and treatments *(ibid)*.

Big data is another crucial terminology that is linked with e-health. In healthcare, the complexity of big data analysis also arises from combining different types of information. Beginning with the collection of individual data elements and moving to the fusion of multiple data sets, the results can reveal entirely new approaches to treating diseases (May, 2014, p.1298).

As referred by the European Commission 'E-health and Health Technology Assessment' report, 'Big Data' surrounds information from electronic health care records, social media, patient summaries, genomic and pharmaceutical data, test results, claims, telemedicine, mobile applications, home monitoring, clinical trials, sensors and information on well-being, behaviour and socioeconomic indicators (European Commission, 2014). The last two decades have seen an explosion in big data throughout the health-care value chain, as well as the beginning of new platforms, tools, and methodologies in storing, structuring, and analysing big data. Important developments include the use of genomic data in drug discovery, the sharing of clinical-trial data, the use of electronic healthcare records (EHRs), and the increased availability of data from m-health applications, patient registries, and social media (Szlezak, 2014, p.492). Bernstein (2014) explains that the concept of data fusion is gaining further implication by the collection of individual data elements that arise the fusing together of multiple data sets.

Another concept that is under the big scope of e-health and also within the context of this research study is the healthcare e-commerce. In general terms e-commerce is the process of buying and selling, exchanging products, services and information via computer networks (Rainer Jr. and Casey, 2011, chapter 7). Currently the use of e-commerce in healthcare is very limited. The most common uses are keeping electronic medical records, the transmission of information and telemedicine. Making medicine accessible online not only benefits clinicians and their patients, it could also improve relationships between hospitals, clinics, suppliers and customers. Due to the rapid progress in technology, the expectations of consumers for quality healthcare are high. Hospitals, clinics and other healthcare providers have to deal with consumer expectation while doing it in the most cost-efficient way (Chee and Yazdanifard, 2011, p.15). Kearns et al., (2002) highlighted the

significant impact e-commerce could have on the cost, efficiency, and quality of the overall management and delivery of healthcare services.

According to Chee and Yazdanifard (2011, p.16), as e-commerce has not been fully taken advantage of and utilized to it's full potential, due to people not being able to completely leave tradition and accept new technology, the key to the success lies primarily in the full participation of consumers and healthcare providers; Healthcare: B2B (business to business). B2B healthcare e-commerce involves transactions and the exchange of information among vendors, hospitals, insurance agencies, state and federal regulators, and doctors' offices where patients, one of the end consumers are not directly involved. A beneficial way to begin using e-commerce is for hospitals, clinics, pharmacies and other healthcare institutions to merge e-commerce and supply chain management *(ibid)*.

Douglas Goldstein (2000, chapter 3) in his book 'The New Health Care e-Consumer and e-Patient' provides a different perspective with taking the patient into the picture, by referring to them as e-consumers, taking a much more active role in their healthcare than others have. According to Goldstein (2000), healthcare executives and providers should be aware that the balance of power is shifting, and access to communication and information on the web will forever change passive patients into informed e-consumers who manage their care as they see fit.

Hence, to conclude the core concepts and terminologies around e-health, it is important to understand the large ecosystem where e-health has many stakeholders such as patients, healthcare professionals and healthcare providers, as well as vendors of technology, pharmaceuticals, healthcare equipment and consumables, insurance companies and healthcare policy makers. The entire scope covers from electronic health records building up national health records to healthcare tele-health based on health information technologies, big data management, consumer health informatics and finally healthcare e-commerce to fasten the transactions and exchange of information among vendors.

Today, e-health still has numerous challenges in many countries regarding implementation and use. There are pros and cons in respect to e-health. The economic benefits versus costs are still questionable. More data on the costs and benefits of e-health interventions is required. In the absence of clear proof of its effects, the decision makers may doubt the effectiveness, which in turn, limits

investment in, and the long-term integration of e-health services (Bergmo, 2015, para. 1). The following section evaluates the history of e-health development. Furthermore the pros and cons of e-health are investigated.

1.3 History of Digital Technologies in Healthcare

Over the past decade medical imaging has transitioned slowly from the use of analog technologies to the digital technologies. In that respect there are several milestones achieved by technology and related terminologies that should be explained, which are still widely common in today's health informatics language and communication.

Telemedicine for example is one of the technologies. As the World Health Organization report demonstrates, information and communication technologies (ICTs) have great potential to address some of the challenges faced by both developed and developing countries in providing accessible, cost effective, high-quality health care services and telemedicine uses information and communication technologies to overcome geographical barriers and increase access to health care services (WHO, 1998). This is particularly beneficial for rural and underserved communities in developing countries; groups that traditionally suffer from lack of access to health care.

The WHO report defines telemedicine as "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities" (WHO, 1998, p.10). Historically, telemedicine can be traced back to the mid to late 19th century (Craig and Patterson, 2005, p.3) with one of the first published accounts occurring in the early 20th century when electrocardiograph data were transmitted over telephone wires (Currell, 2000).

Telemedicine, in its modern form, started in the 1960s in large part driven by the military and space technology sectors, as well as a few individuals using readily available commercial equipment (Craig and Patterson, 2005; Currell, 2000).

Examples of early technological milestones in telemedicine include the use of television to facilitate consultations between specialists at a psychiatric institute and general practitioners at a state mental hospital (Benschoter, Eaton, and Smith, 1965, p.1159), and the provision of expert medical advice from a major teaching hospital to an airport medical centre (Dwyer, 1973, p.866). Recent advancements in, and increasing availability and utilization of ICTs, by the general population have been the biggest drivers of telemedicine over the past decade, rapidly creating new possibilities for health care service and delivery *(ibid)*.

This has been true for developing countries and underserved areas of industrialized nations (Wootton, Jebamani, and Dow, 2005). The replacement of analogue forms of communication with digital methods, combined with a rapid drop in the cost of information and communication technologies (ICTs), have flared wide interest in the application of telemedicine among health-care providers, and have enabled health care organizations to envision and implement new and more efficient ways of providing care (Craig and Patterson, 2005; Currell 2000).

The introduction and popularization of the internet has further accelerated the pace of ICT improvements, thereby expanding the scope of telemedicine to encircle web-based applications (for example; e-mail, teleconsultations and conferences via the internet) and multimedia approaches (for example; digital imagery and video). These advancements have led to the creation of a rich tapestry of telemedicine applications that the world is coming to use (WHO, 2010a, p.9). A national government study conducted in Australia, showed that "cost-effectiveness of telemedicine and tele-health improves considerably when they are part of an integrated use of telecommunications and information technology in the health sector" (Mitchell, 2000, p.16). This led to the identification of "e-health" as a blanket term, with definitions such as "a new term needed to describe the combined use of electronic communication and information technology in the health sector, the use in the health sector of digital data - transmitted, stored and retrieved electronically for clinical, educational and administrative purposes, both at the local site and at a distance" (Mea, 2001, para 1).

In the study of Mitchell J.(2000, p.16) ‘Increasing the cost-effectiveness of telemedicine by embracing e-health’, e-health was presented as ‘the death of

telemedicine', because in the context of a broad availability of medical information systems, that can interconnect and communicate, telemedicine will no longer exist as a specific field. The same could also be said for any other traditional field in medical informatics, including information systems and electronic patient records. E-health presents itself as a common name for all such technological fields *(ibid)*.

Mitchell (1999) also indicated that e-health can be considered to be the health industry's equivalent of e-commerce, and this could be one key for understanding the sense of e-health: just medical informatics and telematics on the shop shelves, a stylish name for something already existing but otherwise difficult to sell.

Allen (2000, p.43), in an editorial remarked a new difference: telemedicine remains connected to medical professionals, while e-health is driven by non-professionals, namely patients (or, in the e-health jargon, consumers) that with their interests drive new services even in the healthcare field-mostly for their empowerment through access to information and knowledge.

Therefore it can be concluded that e-health has evolved over many years starting from very basic telecardiogramme, going through telemedicine to tele-health, and further the improving health information systems opening new arenas for digital fields of connected health. E-health even engages the healthcare e-commerce and m-health globally. The following section aims to look at pros and cons for e-health as it is documented in literature.

1.4 E-health Pros and Cons

Today there is not a complete consensus for the absolute benefits of e-health. Despite a number of efforts to deliver efficient, effective and sustainable e-health systems, e-health systems were not able to display sustainability beyond the pilot phase (Strehle and Shabde, 2006). In resource constrained settings, where both ICT and enabling environments are at the early stage, e-health projects are rarely sustainable, because of inadequate ICT infrastructure, skills and ownership (WHO, 2010b). As mentioned in 'WHO 2010 report; section a', in both developing and developed countries, only a few e-health projects managed to sustain themselves once the initial funding ended (WHO, 2010a). The reported challenges in resource constrained environments are associated with patients' and healthcare workers' resistance to change, lack of ownership, lack of ICT skills or inadequate human

capacity, cultural differences and language barriers, lack of enabling policy environments, weak leadership and coordination, weak ICT infrastructure and services, insufficient financial resources, weak monitoring and evaluation systems and legal issues (WHO, Building Foundations for eHealth, 2006; WHO, report on the second global survey on e-health, 2010a).

However, the full potential and power of e-health will only be realized through greater investments in telecommunications equipment and supporting information technology (Richards, et al., 2005, p.2). For example the use of clinical biometric technology through a personal wearable device allows patients to be monitored at home via a tele-healthcare system (Chun et al., 2005, p.180). According to Kwankam (2004, p.801), e-health systems are essential to keeping pace with the exponential growth of health information and applying this knowledge to resolving world health problems. E-health technology has already demonstrated the ability to provide access to information that will result in improved quality of care for patients. It will also allow for more efficient use of medical resources, a reduction in administrative costs, and facilitate collaboration across the continuum of care. E-health has the ability to reduce health care errors by providing the most appropriate disease-specific clinical care protocols. Additionally, as Harrison et. al., (2006) mention in their study, e-health supports evidence-based medicine as a mechanism to increase the quality and efficiency of the health care system by providing the information technology necessary for communication within provider networks. By linking researchers, clinicians, health care providers and patients, e-health can decrease malpractice liability while improving quality of care *(ibid)*.

Future initiatives in e-health will empower consumers to use health information technology to enhance their knowledge of disease processes and improve their health status. However, it is important to remember that e-health is designed to support the relationship between patients and their health care providers and can never substitute for the personal interaction between patient and provider (Kind and Silver, 2004, p.593).

As the WHO report (2006) states, the developments in ICT provide e-health with various tools and facilities. This offers many new opportunities everyday to improve public health worldwide. For example as given in the case of patients in

Africa being treated from a distance, often by a physician in another country or continent through the use of tele-health (Molefi, 2010, p.11). Another example would be the health professionals in Russia upgrading their skills through e-learning without leaving their countries or national networks of electronic health records making available a patient's entire medical history at any point of healthcare and supporting appropriate treatment *(ibid)*.

The WHO (2006) report clearly emphasizes the essence of strengthening the baseline policies of provision of information and communication technologies for health; supporting citizen protection, equity of access, multilingualism and promoting the growth of e-health capacity, tools and services, encouraging governments, policy makers and international organizations to understand and identify the e-health trends, opportunities and emerging challenges. In 2005, a World Health Assembly resolution acknowledged e-health's potential for improving health systems and safety, quality and efficiency in healthcare (WHO, 2005). With the progresses in implementation of e-health, the WHO (2010a) report mentioned that rising health-care expenditures, the demographic transition, the threat of infectious diseases and increasing multimorbidity make innovation in global health care delivery necessary, and e-health technologies are a promising innovative tool for meeting these challenges.

Geissbuhler and Al-Shorbaji's (2011) study for papers on e-health is another milestone in the development of the field of e-health. Geissbuhler and Al-Shorbaji (2011) emphasize the importance of evidence for e-health services in improving health equity. Similarly Black et al.(2011), mention that evidence is needed to promote equity of access to information and health services, and to strengthen activities and programmes that support local, regional, national and global health communities. Studies have shown health care innovation is very complex and there is still little evidence that e-health technologies can improve health care. Nevertheless, e-health can also improve health equity by facilitating access to health information and services. However, the success of e-health is lagging behind expectations (Black et al., 2011).

Hence today, due to various reasons, there are still doubts about the core value of e-health. The major reason is the limited data to reflect the economic, clinic and social

benefits. Clinical and cultural adaptation of e-health users and resistance to change conventional methods are other limitations. On the other hand, as previously mentioned, health systems around the world are combating to find effective ways to make clinical practices safer, more effective, and evidence based (Enrico Coiera (2011, p.27). As argued by Coiera in his study 'Why system inertia makes health reform so difficult?', the reason may be system inertia. In that case the system inertia is a conundrum, and a source of deep frustration, that health systems seem so resistant to change (Braithwaite and Coiera, 2010, p.219). Also safety and quality initiatives struggle to make care safer for patients (Braithwaite, Westbrook, and Iedema, 2005). Restructuring health services seems to achieve limited evidence based recommendations; standards are ignored or poorly executed (Braithwaite, Westbrook and Iedema, 2005; Grimshaw and Eccles, 2004).

Pijnen et al. (2011, para.1) states that many e-health technologies could not provide long-term inventions in health care applications. According to Pijnen et al. (2011), the actual progress of e-health technology often disrespects the inter-connections between technology, human nature, and the socioeconomic environment. Therefore, the results of this new technology has a weak effect in health care practices. To succeed in dealing with the challenges of e-health design and implementation, a creative approach to the development of e-health technologies is needed; one that considers the complex dynamics of health care and the conventional characteristics of patients and other stakeholders *(ibid).*

According to Coiera (2011), the classic approach to e-health development has caused disbelief because it is technology oriented, thereby promoting the impression that e-health is mainly about technological intervention. This has caused the design of stand-alone devices and device-based applications that ignore the complexity of real life. The classic model has also slowed the penetration of innovations into care; Innovation calls for education and training rather than for specific applications. It also calls for better models of reimbursement and governance tailored to patient engagement and home care *(ibid).* The misconception that implementing e-health is a one-step process, leads organizations to budget for implementation and to neglect maintenance (Paterson et al., 2010). E-health incorporates a different set of informatics tools that have been designed to improve public health and health care. As referred in paragraphs above, limited data is

available on the effects of e-health programmes, especially in low- and middle-income countries. One of the studies covered a review of the published and non-published literature to identify data on the effects of e-health on health outcomes and costs (Piette et al., 2012). The results of this study encourage the identification of unanswered questions for future research, notably on topics relevant to low- and middle-income countries. Even if e-health tools supporting clinical practice have increasing penetration globally, there is more proof of benefits for tools that support clinical decisions and laboratory information systems than for those that support picture archiving and communication systems. Public information systems for disease control have been implemented successfully in several low- and middle-income countries (Piette et al., 2012, p.365).

Even though information on outcomes is generally lacking, a large project in Brazil has documented notable impacts on health-system efficiency. Meta-analyses and rigorous trials have documented the benefits of text messaging for improving outcomes such as patients' self-care. Automated telephone monitoring and self-care support calls have been shown to improve some outcomes of chronic disease management, such as glycaemia and blood pressure control, in low- and middle-income countries. Although large programmes for e-health implementation and research are being conducted in many low- and middle-income countries, more information on the impacts of e-health on outcomes and costs in these settings is still needed (Piette et al., 2012).

Another study conducted by the National Health Service (NHS) group of researchers from UK is a methodical search and critical of the factual literature on e-health applications and their effects on the quality and safety of healthcare delivery; this research is synthesized with theoretical, technical, developmental and policy relevant literature with a view to producing an authoritative and accessible overview of the field (Black et al., 2011). The consequential conclusion that arises from this work relates to the significant potential that e-health applications provide in transforming, personalising and improving the accessibility of care but that, perhaps unsurprisingly, given the relative immaturity of this field of enquiry, it remains highly unclear to what extent this potential will be successful *(ibid)*. According to Black et al., (2011), factors contributing to this doubt include the fact

that, unlike in many other areas of medicine, interventions often continue to be implemented based on the simplistic assumption that the benefit associated with their introduction is self-evident but also that given the importance of end-user acceptance and engagement with the technology, realizing the benefits of this technology is highly context dependence. What has not been beneficial is that in some, or possibly many cases, technology has been introduced without sufficient attention to the needs of end-users. As an example, the innovation has been technologically rather than clinically driven. Therefore, as a result of this, interventions are introduced which have very little clinical applicability and if anything make delivery of high quality care harder to achieve than was previously the case. Integration and interoperability are extremely important considerations in ensuring that these technologies actually encompass with existing working patterns and it is therefore crucial that national standards are agreed, communicated to technology developers and then applied *(ibid)*.

Limburg et al. (2011, para.1) claims that, recent frameworks for e-health growth experience challenges of appropriate infrastructures and funding. According to Limburg et al. (2011), scalable e-health frameworks are still complicated; their effectiveness and long-term performance are questionnable. There have been several analyses done as mentioned in literature to highlight these issues by defining a better implementation strategy early in the development of e-health technologies. Therefore, business modeling would guide to identify such an implementation strategy, by gathering the ideas of all essential stakeholders on what the technology should achieve. This approach also seems encouraging to e-health, as it can contribute to the entire progress of e-health technology *(ibid)*.

As Bouamrane and Sarkar (2015, p.2) state, in recent years, there has been considerable improvement in the use of clinical informatics systems to support clinicians during episodes of care, manage specialised domain knowledge, perform complex clinical data analysis and improve the management of health organisations' resources. However, the vision of fully integrated health information eco-systems, which provide relevant information and useful knowledge at the point-of-care, remains ambiguous *(ibid)*. Challenges still remain regarding interoperability and complexity in clinical informatics systems. Furthermore, a range of approaches are proposed in order to address harness and resolve some of the many remaining issues towards a greater integration of health information systems and extraction of useful

or new knowledge from heterogeneous electronic data repositories *(ibid).* As mentioned earlier, evidence based health informatics is crucial for the development of e-health. Ammenwerth's study, 'Evidence Based Health Informatics' states that health IT is expected to have a positive impact on the quality and efficiency of health care whereas reports on negative impact and patient harm continue to emerge (Ammenwerth,2015).

The obligation of health informatics is to make certain that health IT solutions provide as much benefit with as few negative side effects as possible. To achieve this, health informatics as a discipline must be able to learn, both from its successes as well as from its failures (Ammenwerth, 2015, p.298). Today many of the websites provide health information of different qualities searched by health professionals as well as by non-professionals. Therefore, online health information has currently become one of the most significant information sources for people pursuing health information. (Xiao et al., 2014).

A study by the Office for National Statistics reports that 43% of surveyed British internet users have accessed health information online and this figure increases to 59% among those aged 24–35 (Statistics, 2013). The number of UK internet users who check health information online has reached 49% in 2015 (Statistics, 2015). In developing countries, mobile phone technologies have improved health outcomes for chronic disease conditions such as diabetes, heart disease and hypertension (Sahu et al., 2014, p.269).

The use of e-health, a term that describes the application of information, computer or communication technology to some aspect of health or healthcare, is viewed as essential to solving problems, facing healthcare systems (Gemert et al., 2012).

The European Commission states that e-health will play a key role in structural reforms that are needed to ensure the sustainability of health systems while securing access to services for all citizens (European Commission, 2012b).

Waterson (2014), has mentioned in his study that, substantial national initiatives designed to coordinate e-health implementation are underway across the world and this trend is likely to increase in the future; Examples of e-health technologies becoming widely used include: management systems, such as the electronic health record (EHR), which allow the acquisition, transmission and storage of patient data; computerised decision support systems including diagnostic support, alerts and

reminder systems; communication systems such as telecommunication; and information resources such as the internet.

In 2002, the National Health Service (NHS) allocated £11.4 billion to reform the UK's healthcare system (Public Accounts Committee, 2011) and this has included the on-going introduction of many new e-health systems such as: broadband networks; systems to electronically share X-rays; the creation of an integrated EHR system; and the NHS Choices website, which provides health information to the public via the internet. Despite the potential benefits of e-health, implementation of these systems is often reported as problematic. Implementation of EHR and electronic prescribing systems have been very slow in most European nations as well as in the USA (Assuli, 2015, p.287). Costs associated with implementing e-health often high and time delays are reported (Public Accounts Committee, 2011). Barriers to implementation of innovations within the healthcare setting may arise at the individual, organisational and wider levels of the healthcare systems, and interact in complex and variable ways (Lau et al., 2014).

According to Stroetman et al. (2012), these factors may also be innovation-specific and context-specific. Studies have described financial, legal, social and ethical barriers to implementation, arising at the organisational and individual level, including users' lack of awareness of the benefits, low e-health literacy, a shortage of evidence of cost-effectiveness and interoperability (the ability of different information technology systems and software applications to communicate, exchange data and use the information that has been exchanged) as well as security concerns *(ibid).*

Recognising and understanding barriers and facilitators is crucial for devising strategies and interventions to improve the widespread effective use of e-health, and addressing blockages to implementation. A systematic review of reviews by Mair et al. (2012, p.357), synthesised the literature on the implementation of e-health interventions in healthcare settings published up until 2009. This review found a growing emphasis on problems related to e-health systems' workability and ways innovations affect organisational structures and goals. The review highlighted the need for adequate resources, particularly financial, as well as administrative support, policy support, standards and interoperability. Relatively little attention was found to be given to: e-health's effects on roles and responsibilities; risk management; ways to engage with professionals; and ensuring that the potential

benefits of new technologies are made transparent through ongoing evaluation and feedback *(ibid)*.

The factors that promote or inhibit the implementation of e-health may also have evolved over this time, given the dynamic and expanding nature of e-health utilisation in healthcare systems, and new challenges and strategies for overcoming them may be reflected in the literature. It has been also reported that many ICT for health systems could not demonstrate sustainability beyond the pilot phase, or after the initial investment of the project had dried up (Fanta et al., 2015).

According to Fanta et al. (2015), some of the sustainability challenges of e-health implementation in resource constrained environments are related to weak ICT infrastructure; shortage of funding; lack of technical skill to support technologies brought from the developed world; and the introduction of technologies that were not innovated in the context of developing countries. Although the implementation was successful for e-health, implementing systems is a global challenge; developing countries exhibited much more failures than the developed ones. Several e-health implementation frameworks have been reported on literatures. However assessing the ability of these frameworks to ensure sustainability of e-health systems in resource constrained setting is a real challenge *(ibid)*.

As conducted in a research study in South Africa, the evaluation framework for sustainability of e-health systems considers the three pillars of sustainability (social, environmental and economic factors) to evaluate e-health system's operational environment, and technological factor to evaluate the systems of interest. The majority of e-health sustainability factors link to the environments in which systems function. It is also observed that most e-health success challenges are associated with system environments that differ significantly in developing and developed worlds *(ibid)*.

Discussions are expected to continue untill e-health will be properly implemented in many parts of the world till the economic and social impacts of e-health are quantified and hopefully, proved for positive results, thus benefiting the overall healthcare system. The use of e-health includes networking, facilitated global thinking, and improved health care on local, regional, and national levels (Cashen, P., and Gerber, 2004). As discussed by Austin and Boxerman (2003), e-health will become a major factor in the infrastructure of health care. However, due to the open architecture of the internet, organizational policies and procedures are needed to

guarantee the privacy and integrity of e-health systems. These policies need to focus on data security as well as the other ethical issues pertaining to e-health *(ibid).* The goals of e-health can be summarized to include increased efficiency in health care, improved quality of care, increased commitment to evidence-based medicine, empowerment of patients and consumers, and the development of new relationships between patients and health professionals (Austin and Boxerman, 2003).

From a global perspective, e-health can be used to distribute health information as well as ensure that the most current information is used to improve people's health (Kwankam, 2004). Rural areas may benefit the greatest of e-health by having easier access to information and access to telemedicine services *(ibid).*

According to Richards and colleagues, the use of e-health in rural areas is important considering 95% of respondents have used the internet and many have access to scanners, digital cameras, and videoconferencing. "Certainly telecommunication infrastructure and internet access is still questionable in developing and underdeveloped countries" (Richards et al.,2005, p.3).

Kwankam (2004, p.800) claims that, e-health structure can eliminate time and distance hurdles for the effective health information circulation and can assure that collaborative data and information is gathered to bring solutions to the health problems throughout the world.

Austin and Boxerman (2003, chapter 3) also explain four critical areas of e-health: e-business, consumer marketing, organizational management, and clinical customer service. Some of these are reached via the public internet, while others are restricted by passwords on intranets or local area networks.

According to Deluca and Enmark (2000), e-business comprises online procurement processing between health care providers and suppliers, online electronic claims processing, eligibility authorization from insurance companies, and consumer purchase of prescription drugs and health insurance. As of the year 2000, electronic claims submission and materials management were the most widely implemented e-health technologies in health care. For example, one large practice association automated nearly half of their claims volume with an internet-based claims submission system and reduced their per-claim processing cost by almost 40% as mentioned in the study of Deluca and Enmark (2000).

Additional clinical applications include real-time alerts, clinical screening, and access to reference materials for physicians. Many clinicians now keep patient information in an electronic format and access this information by downloading into handheld computers or personal digital assistants (PDAs) whenever patient-specific decisions need to be made referred by Pancoast, Patrick and Mitchell in their studies (2003). In 2004, 40% of practicing U.S. physicians owned a PDA, up from 19% in 2001 (Chin, 2005, p.26). This represents more than four times greater PDA usage among physicians than the usage rate of consumers *(ibid)*. However, PDA's have yet to be used to their fullest potential in medicine and new developments may encourage greater usage. Smart phones will continue to evolve into mobile computing devices that will have computer capabilities with the ability to still be able to fit in your hand *(ibid)*.

The literature review and the conducted field research show that challenges still exist. Many advanced countries have progressed significantly during the last decade, now that e-health has become popular and more recognized at clinical, social and governmental levels.

Today countries such as USA, Canada, Australia and certainly the European Union referring to many advanced Europe countries have significant progress in e-health implementation and application. Their governments' encourage their citizens to collaborate on electronic health records (EHR) to control and check their own health records and be more empowered around their own health and destiny. In that aspect, the government initiatives, structured engagement and education of healthcare professionals, industry providers and patients are very crucial for progress and outcomes in e-health.

1.5 Global E-health Initiatives

For nearly two decades, the USA, Canada, Australia and many countries in Europe have been implementing an e-health policy. Today the European Commission has a concrete plan and roadmap for Europe which can be referred as 'Digital Agenda for Europe'. Under this agenda, it is clearly stated that information and communication technology for health and wellbeing (e-health) is becoming increasingly important to deliver top-quality care to European citizens (European Commission, 2015). The European Commission has been investing in e-health research for over 20 years. Since 2004, when the first e-health Action Plan was launched, it has also been

developing targeted policy initiatives aimed at fostering widespread adoption of e-health technologies across the EU *(ibid).* In 2010, 'Digital Agenda for Europe and Innovation Union' were launched as a part of the 'EU's Europe 2020 Strategy' for smart, sustainable and inclusive growth. Both initiatives incorporate an important role for e-health: the Digital Agenda for Europe includes a number of targeted e-health actions and goals as part of a wider strategy towards sustainable healthcare and ICT-based support for dignified and independent living. The Innovation Union strategy introduces the concept of a pilot European Innovation Partnership on active and healthy ageing, which was put into place in 2011. There has been also an ongoing European Commission public consultation on e-health. The answers of the consultation are used to feed into the preparation of the e-health Action Plan 2012-2020. This process aimed to contribute to the definition of the future research activities aiming for better diagnosis, early detection and management of diseases, in particular with the use of personalised guidance of patients and of modelling and simulation techniques (European Commission, 2015).

The first EU e-health Action Plan 2004-2011 covered electronic prescriptions and health cards to new information systems that reduce waiting times and errors, in order to facilitate a more harmonious and complementary European approach to e-health.

The second 'E-health Action Plan, 2012-2020' operates in the context of Article 14 of Directive 2011/24 on the application of patients' rights in cross-border healthcare. It focuses on the following:

- Supporting research, development and innovation;
- Promoting international cooperation;
- Achieving wider interoperability of e-health services;
- Ensuring wider deployment and facilitating uptake.

Together with the e-health Action Plan 2012-2020, the Commission issued a 'Staff Working Document' (SWD) on Telemedicine to help deal with the legal aspects related to data protection rules, privacy matters and reimbursement. Hence both the 'E-health Action Plan and the SWD on Telemedicine' are intended guidelines and are not binding on Member States. In addition there is so called e-health network which is a voluntary network of representatives from all national authorities in the

EU. It draws up guidelines, for example on how to apply patients' rights in cross-border healthcare. In general, the network aims to enhance interoperability between electronic health systems and continuity of care and to ensure access to safe and quality healthcare (European Commission, 2015).

The Digital Agenda for Europe includes three specific actions on e-health aimed at widespread deployment of telemedicine, patients' access to their health data and interoperability (European Commission, 2015). Despite the economic crisis, the global telemedicine market grew from $9.8 billion in 2010 to $11.6 billion in 2011, while the global m-health market is set to grow to €17.5 billion a year by 2017. Some EU governments are spending up to 15% of their budgets on healthcare. These facts indicate fast-changing situations that the e-health Action Plan must be flexible enough to address. The European Commission has been active in e-health for over a decade *(ibid).*

Past Commission actions include:

- 2004 first e-health action plan.
- 2008 Commission communication on telemedicine.
- 2008 Large scale pilot renewing health, which is measuring the efficiency and cost effectiveness of telemedicine services across 9 regions of Europe.
- 2008 Recommendation on interoperable electronic health records.
- 2011 adoption of the first EU law with provisions on the inter-operability of e-health, the Directive on Patients' rights in cross border healthcare.
- '2011 epSOS Large Scale Pilot' has brought together 23 countries to pilot cross-border patient summaries and ePrescription services across Europe.
- '2011 European Innovation Partnership on Active and Healthy Ageing' (EIPAHA) which builds on 261 commitments from over 3000 EIP AHA stakeholders to improve the quality of life of four million European senior citizens between now and 2015. The commitments, include the roll out of integrated care and chronic disease management using innovative telemonitoring solutions.
- 2012 Launch of the e-health Network bringing together all EU Member States to work on guidelines for the interoperability of e-health (European Commission, 2015).

The UK also has a highly developed e-health infrastructure as a whole. England was one of the first countries to invest heavily in e-health (Butterfield, 2011). According to the European Commission "E-health Priorities and Strategies for European Countries, Era Report" (2007), the English program originally envisioned regional deployments of clinical systems with an interoperability 'spine' to connect the regions, plus a number of national applications (e-prescriptions, appointment scheduling). National Health System England (NHS) is developing an 'NHS Technology Strategy and Roadmap', setting a national direction for NHS IT. NHS England has published its Business Plan for 2013-14 - 2015-16 called 'Putting Patients First', which explains how it will deliver its mandate from the government (NHS, 2012; European Commission, 2012a).

One of the plan's key targets in relation to IT has been to have 95% of trusts using the NHS Number as the prime identifier in clinical correspondence by January 2015. 'Putting Patients First' report says, NHS England will "set the direction for NHS technology and informatics so that commissioners, providers and suppliers can make informed investment decisions" (NHS, 2012, p.2). NHS has declared that in co-production with key strategic partners and in consultation with stakeholders, they woud develop and publish an evidence-based NHS Technology Strategy and Roadmap *(ibid).*

Other developments outlined in the plan include an integrated business intelligence tool, which will "provide the robust information needed for evidence based, insightful decision making for all parts of NHS England" (NHS, 2012). It would also develop a linked package of shared-decision making aids so that people can make choices in collaboration with clinicians about their treatment. The plan says that, health and care data is one of England's greatest public assets and "putting it to work" is key to improving patient outcomes *(ibid).*

Great Britain encircles a set of distinct legal frameworks just as it has four distinct healthcare systems (NHS, 2013). In general, the fact that healthcare is provided directly through National Health Services significantly eases the legal prerequisites to implement e-health services. As the advanced nature of the British e-health landscape indicates, the necessary amendments have generally already been made, assuring not only the possibility of introducing ePrescription and EHR

solutions, but guaranteeing their equality to their traditional counterparts as well *(ibid)*.

The report of 'Healthcare Information and Management Systems Society (HIMSS)' edited by Arnold et al., (2007, p.15) state that the U.S seems to fall behind in many distinct and important categories of EHR implementation. The U.K., Australia, New Zealand, Denmark and Canada already have standards that are agreed upon and mandated by national or private entities; funding via national sources or a mix of private and public funds; and good communication between vendors and systems (for example interoperable systems) *(ibid)*.

According to Arnold et al. (2007) and Coiera (2009), the U.S.A, on the other hand, is still working towards developing its standards. This is complicated by the fact that there are so many vendors to choose from as compared to other nations. Although this tends to widen the gap in standards, functionality and usability, the Certification Commission for Health Information Technology (CCHIT) is focused on standardizing functionality, while the Health Information Technology Standards Panel (HITSP) is focused on developing standards for interoperability.

The U.S. government has introduced legislation to support implementation of EHRs. Healthcare information technologies (HCIT) initiative is part of the Nation's strategy to put information technology to work in health care. By developing secure and private electronic health records for most Americans and making health information available electronically when and where it is needed, health IT can improve the quality of care, even as it makes health care more cost-effective (Arnold et al., 2007).

According to HIMSS report (2010), driven by the internal need for better and more cost-effective healthcare, EHRs will become standard in all developed and developing countries of the world in the future.

This report also claims that one of the major barriers to global e-health adaptation has been cost. In addition to cost, fear of technology and change will continue to impact EHR adoption at the clinical user level. Over time, continued education, trust, security, standardization, improved functionality and usability, and growing familiarity with healthcare IT will ameliorate these fears *(ibid)*.

According to the European Commission 'E-health Action Plan 2012-2020' (European Commission, 2014) the WHO, OECD and other international bodies

have all underlined the importance of a global coordinated approach to tackle the specific issues related to e-health.

Recent initiatives have outlined the challenges of interoperability and specifically of the use of common terminologies at international level as some of the key components for market growth.

In this context, the European Union (EU) signed in 2010 a 'Memorandum of Understanding' with the United States of America on interoperable e-health systems and skills *(ibid).*

CHAPTER 2

OBJECTIVES AND SCOPE OF THE STUDY

2.1 Research Question and Objective

Given the background of the study and overview of the research problem in the first chapter, a comprehensive understanding is needed for the major challenges of e-health implementation as well as further utilization capabilities and outcomes particularly in emerging markets where governments are continuing to put forth efforts for initiation and development. User insights are a key as users refer to the different stakeholders that are engaged with e-health practices in various environments and roles. Thus the central research question to be addressed in this exploratory study is: '**What are the major challenges for the implementation and development of e-health in an emerging country and what are the expected outcomes of utilization ?**'.

To answer the above research question, the aim of this study is to develop and test a comprehensive conceptual research framework that asssesses a country's e-health development challenges and possible outcomes of utilization based on user insights. The spesific objective of this study is to investigate and understand the contribution of factors such as, **technological infrastructure, regulation and policy standards, financial initiatives, clinical cultural adaptation capabilities, and impact of user trust to the development of e-health and the expected outcomes of utilization in a country**. This objective is conceptualised into testable hypotheses in the third chapter of this study.

2.2 Proposed Conceptual Framework

A number of developed countries have already progressed significantly regarding implementation and utilization of e-health, whereas e-health is still facing barriers and issues of growth in other developing countries. Additionally the outcomes and

benefits of utilization are also questionable as there is no consensus. Even if there are many variables to build up the major challenges, some of them are more persistent and play a significant role for development and utilization.

One of the possible major challenges in e-health development is the clinical cultural adaptation. Clinical cultural adaptation essentially refers to the adaptation of healthcare professionals and staff to the use of new information technologies in their hospital. Adapting to new technology not only requires acceptance of the change, but also requires learning and understanding of the new technology (Leonard-Barton and Kraus, 1985, p.102).

There have been solid developments in information technology (IT), hardware and software capabilities over recent decades and there is now considerable potential to implement and utilize these technological developments for healthcare provision. On the other hand, there is concern that even when high quality interventions are developed, they rarely succeed when applied in the 'real world'. A major factor contributing to this paradox is professional resistance to their introduction and use due in part to relative lack of sophistication and an at risk adverse culture of practice (Black et al., 2008).

As with the implementation of any information system in an organisational context, the acceptance of any information system requires proper planning and management for change (Callioni, 2006, p.31). With EHR implementations, change occurs not simply due to the introduction of ICT infrastructure but also because the job design of interconnected health professionals should be reengineered to effectively and efficiently accommodate the technology (Ford et al., 2006).

ICT infrastructure readiness is another key challenge for e-health development. Recognizing the significant developmental role and cross-cutting impact of information communication technologies (ICTs) in regard to all aspects of national life, including health, an ICT-related target was included in 'Millennium Development Goal" stated by the WHO report (WHO, 2006). According to Anwar et al., (2012) and Kundi (2010), the developing countries do not have appropriate required infrastructure and professionals for e-health implementation and development. Therefore, availability and effective use of ICT infrastructure is crucial for successful adaptation of e-health systems (Qureshi et al., 2013, p.163).

Developing countries are now waking up to the realization that they have to accept information and communication technologies to deal with the problem of access, quality and costs of healthcare (Mugo and Nzuki, 2014). The adoption of ICT in health sector across developing countries will also accelerate knowledge diffusion and increase access to health information (Ojo et al., 2007, p.49).

Having completed an assessment of the strategic requirements, e-health potential and affordability, the focus can shift to choices and decisions about the ICT that should be part of the e-health investment plan (Jones, 2011). Therefore, decision of financing e-health implementation would also be crucial for e-health development in a country and infact findings show that increased funding in health sector is strongly correlated with adoption of e-health even in the case of developed countries and this should also be the case for developing countries (Yu, 2012).

E-procurement or in other words an integrated supply chain management is another useful outcome of e-health implementation and the optimization of procurement processes for medical and pharmaceutical products, helps hospitals reducing costs and increasing their cost transparency, treatment quality and patient safety (Bartsch et al., 2013). However, due to the great amount of stakeholders and interfaces taking part in procurement processes a structured methodology is required for comprehensive documentation and analysis safety *(ibid).*

Another key discussion point of challenges for e-health implementation development, is the impact of trust to patient privacy and therefore the security of big data use in digital health. This is also one of the major interests of this distinctive field study.

According to a literature review conducted by WHO (2012), the findings of the second global survey on e-health states that, respect and protection of, patient privacy has a well established history in global legal terms; it is generally accepted that such protection of privacy is not only a fundamental right of the individual, but also a core requirement of how health care is practiced therefore the respect for the privacy of the individual is crucial to the trust relationship between patient and healthcare-provider. This report further highlights that, the more recent literature covering scholars across disciplines of philosophy, sociology and medicine, have all noted that health care is changing (WHO, 2012).

It is moving from being based in a long-term relationship between a patient a small number of doctors to a series of shorter relationships with a much wide range of health-care professionals, which may be conducted online or on the phone as well as through more traditional face to face interaction; it is becoming more and more important to have a clear legal framework of privacy legislation directly applicable to healthcare as it is practiced today, whether that is in person or through an ICT medium (WHO, 2012). Additionally the same report presents that almost 70% of the 113 responding countries have some sort of privacy legislation in place where the European Region has the highest uptake among WHO regions.

A further analysis of the responses of this report shows that in general higher income countries have a higher prevalence of legal protection of patient privacy than lower income countries (WHO, 2012). Privacy and trust are inextricably linked in healthcare and therefore public trust especially healthcare professional engagement in use of electronic health records for better healthcare delivery should be facilitated by clearer legal guidelines on rights and duties *(ibid)*. In fact privacy and security are critical success factors in the movement toward EHR adoptation (Rinehart et al., 2009, p.7).

Given the sensitive nature of medical information, and healthcare professionals' high degree of dependence on reliable records, issues of integrity, security, privacy, and confidentiality are of particular significance, and thus security must be clearly and effectively addressed by e-health applications (Sabnis and Charles, 2012, p.105). Security of electronic health records and patient privacy is still a big concern for many healthcare professionals based on the customer interviews within the scope of this study.

Another major challenge, that is considered in this research study is the impact of regulations and policies for e-health implementation in that country. As emphasized in their study by Khoja et al. (2012) there needs to be policies at different stages of e-health planning process, as well as from different levels of decision makers. It is important for the policymakers to understand the importance of these issues, and take a pro-active approach to develop policies that allow for smooth and reliable planning of e-health programs *(ibid)*. According to Coiera (2009), building national healthcare IT systems involves definiting a policy and framework which would

shape the concurrence of public and private. In fact, many strategies suggest that development of supportive policies should be part of the e-health strategies of the countries and the organizations. It is therefore important to increase awareness of health care providers and managers on e-health policy issues as well as to provide them guidelines and support to develop these policies (Khoja et al., 2012).

Today many developed countries progressed regarding building their national health information systems whereas this is still in progress or at beginning level for many emerging countries where governments have planned actions for e-health implementation and utilization. It is crucial to know the challenges to be faced and solved for a successful implementation and development of e-health. This is even more important in developing countries, where uncertainity and instability are common (Luna et al., 2014, para.1).

The literature review in this study presents a detailed evidence for the critical role of ICT infrastructure readiness, regulations, financing, supply chain management, clinical cultural adaptation, trust to patient privacy and related big data use in digital health for proper e-health development and utilization in a country.

This review is also aligned with the initial face to face interviews conducted with some healthcare professionals in the selected countries, to assess the probable major e-health development challenges based on their insights. Therefore, each of these highlighted challenges in literature is assigned to a hypothesis, to build a distintive model and is tested statistically. This is explained in detail in the section of data and methodology.

The unique model developed in that study which is presented in Figure 2.1 below, considers those major challenges and evaluates their impact and contribution for the e-health development in that country, based on user insights.

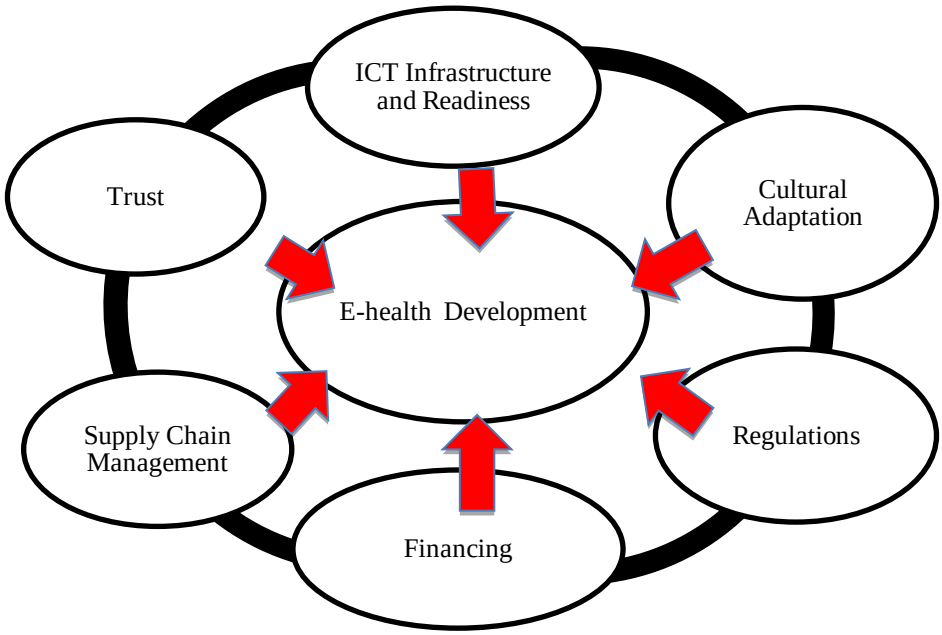


Figure 2.1: Proposed Conceptual Model of Framework, Assessing a Country's E-health Development

2.3 Scope of the Study

Based on the research problem mentioned in section 2.1, this study is a 'Comparative Field Study in Four Emerging Markets; Turkey, Kingdom of Saudi Arabia, United Arab Emirates and Egypt on e-health Development Challanges and Expected Utilization Capabilities'. This study aims to clarify the major e-health implementation challenges and expected outcomes of utilization across Turkey, Saudi Arabia, UAE and Egypt based on user insights. This research study does also aim to compare and analyze the similarities and differences among those four selected emerging markets.

A new framework model as shown in Figure 2.1 is designed to identify the major challenges and to analyze its possible solutions to overcome those barriers for an impactful e-health implementation and utilization in that country. E-health has many stakeholders regarding implementation and utilization. Doctors, heathcare professionals and Ministry of Health authorities are the major stakeholders that have been covered within the scope of this study. One of the core stakeholders regarding use of e-health in a country are patients, are not covered within the scope of this study based on the fact that the e-health practices are more at the stage of implementation. This study is also looking for the user online buying behaviour and approach for healthcare products, which is e-commerce that is captured under e-

health practices. Another key area that has been in the scope of this study is to understand and compare the perceptions of doctors with healthcare information technologists and other healthcare IT professionals regarding their approach and expectations to e-health and related e-commerce practices in healthcare. Finally this study, also explores the perceptions with respect to big data extracted and its outcomes based on expert user views and insights.

2.4 E-Health Market Dynamics; Egypt, Kingdom of Saudi Arabia, Turkey and United Arab Emirates

2.4.1 E-Health Initiatives in Kingdom of Saudi Arabia

According to data released by International Data Corporation (IDC, 2014), spending on information technologies (IT) among healthcare organizations is increasing in Saudi Arabia, South Africa, Turkey, and the UAE. Over a five-year period from 2012 to 2017, spending will jump by just under 10 percent annually. The purpose of the spending varies by country. For example, in Saudi Arabia, IT spending is linked to modernization and expansion of hospitals and clinics, as the country aims to expand capacity by at least thirty thousand beds nationwide. In South Africa, remote outreach and e-delivery are top priorities, as the number of qualified professionals in rural and poor areas have collapsed due to doctors seeking comfortable urban jobs in the private sector or heading abroad for more lucrative opportunities (IDC, 2014). Additional highlights from the data about the four countries include: healthcare is the second-fastest- growing sector after government regarding IT spending. Saudi Arabia is the fastest-growing healthcare IT market, rising by around eleven percent annually *(ibid)*.

The efforts for the e-health initiatives in the Kingdom of Saudi Arabia go back to the years 2000 when the government of Saudi Arabia formed a health reform committee to conduct a comprehensive review of the healthcare services provided to its citizens (Altuwaijri, 2010). The committee highlighted that a lack of proper health informatics was one of the top challenges facing the Saudi health *(ibid)*. Since 2002 the health IT strategic plan has been launched with core aims of building health informatics framework, establishing health informatics society, designing e-health records and expanding telemedicine. In 2005, SAHI which is the

Saudi Association for Health Informatics was established. By 2006, Saudi Arabia e-health conferences have begun to start, and they still maintain a good momentum to continue and host many visitors from different parts of the world (Altuwaijri, 2010, p.123). Since 2008 there have been the attempts for setting up the national e-health programme. The e-health programme is planned in such a way that is linked and coordinated with the Ministry of Health strategic objectives. The Ministry of Health (MoH), Kingdom of Saudi Arabia, launched the e-health programme and the related strategy in 2011 which is planned to be implemented in two phases where each phase is referred as a five year programme *(ibid)*.

According to the official website Ministry of Health, Saudi Arabia shares the business strategy with its related objectives and initiatives that can be obtained by e-health. The mission states to build a safe, quality health system based on patient centric care, guided by standards and enabled by e-health (Ministry of Health, Saudi Arabia official website, 2016). Saudi Arabia healthcare providers consist of mainly three groups where Ministry of Health has about 59% of the capacity, followed by 20% of other government sectors and about 21% of the private sector (Ministry of Health, Strategic Plan 2010-2020, 2016).

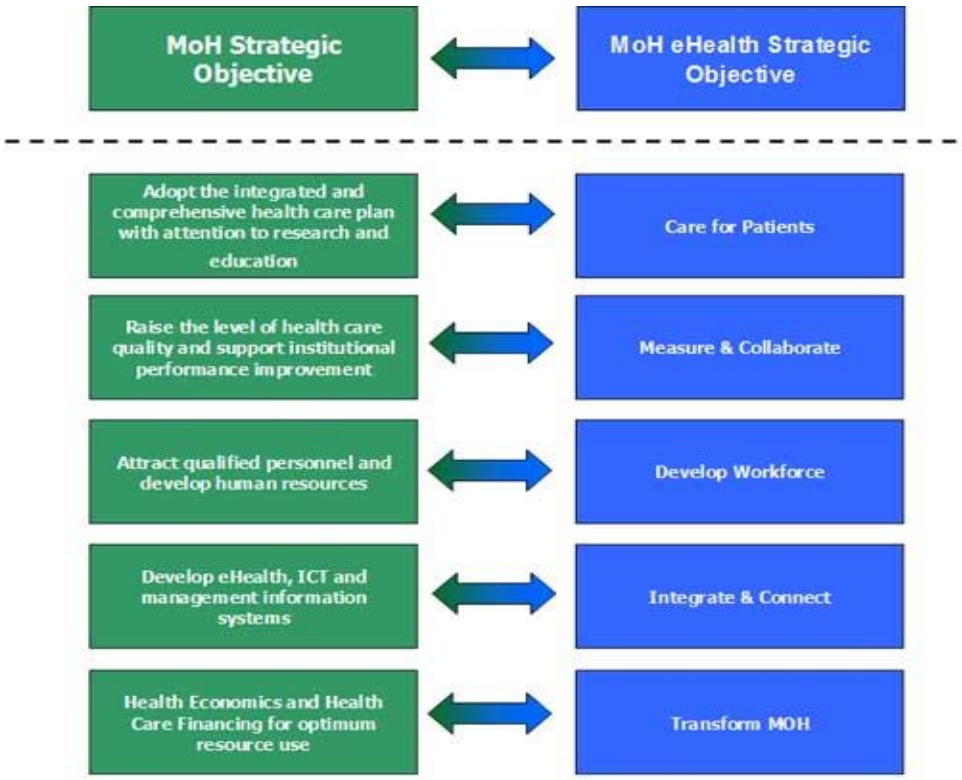
Today based on the Ministry of Health reports and expert views, Saudi Arabia has about 449 hospitals of which 270 are ministry of health hospitals, 2281 primary health clinics, about 38 hospitals from other governmental sectors such as National Guard Health Affairs, Armed Forces Medical Services, Security Forces Hospital Programme, university hospitals and semi governmental hospitals as well as about 141 private hospitals.

In that respect MoH Saudi Arabia has designed an e-health strategic framework to guide the development of the e-health strategy and produce a roadmap that would provide a connected secure, patient-care oriented healthcare infrastructure by the year 2020 (Ministry of Health, Strategic Plan 2010-2020, 2016). MoH strategic e-health objectives are set as care for patients, measure and collaborate, develop the workforce , integrate and connect, thus finally transforming MoH *(ibid)*. Based on the expert interviews, the “Integrated and Comprehensive Health Program of Saudi Arabia" is targeted to have close to 3000 plus e-health facilities with about 70000 beds capacity using a single patient health record by the end of that implementation

where the the first phase has been for primary care hospitals. The roapmap is to have over 2000 old primary health centers to receive new automated standardized systems which would enable to share patient information between hospitals, labs and speciality clinics. This integration has some core points of action for achieving the e-health strategy such as development of skilled healthcare IT resources, change management, standards and policies for the entire workflow and patient privacy.

In that respect, "Change Management" refers to the adaptation of new concepts, skills, and processes that needs to be learned and adapted by the healthcare staff, healthcare professionals, and even the patients. For this reason, the Saudi Ministry of Health has established an e-health change management office as a part of the Strategy and Change office.

Table 2.1 E-health Strategic Objective, Kingdom of Saudi Arabia
(Ministry of Health Kingdom of Saudi Arabia, Strategic Plan 2010-2020, 2016)



Within the scope of phased framework, the key target milestones, for early adopters, are defined at years 3, 5, and 10 as shown below also publicly shared on the official Ministry of Health website :

Table 2.2 E-health Strategy Target State; Ministry of Health, Kingdom of Saudi Arabia
(Ministry of Health Kingdom of Saudi Arabia, Strategic Plan 2010-2020, 2016)

2.4.2 E-Health Initiatives in United Arab Emirates

The report from Frost and Sullivan (2012), claimed that the Gulf Countries spending on healthcare information technology (IT) needs are expected to have reached to more than $550m by 2015, where a considerable part of that is said to belong to initiatives in the Kingdom of Saudi Arabia. This is aligned with the International Data Corporation report (IDC, 2014).

Saudi Arabia is followed by UAE who also has investments in national e-health policy and also WAREED, the largest health information system project by the Ministry of Health in the UAE. WAREED is an electronic health information system virtually linking all the Ministry of Health facilities in Dubai and the Northern Emirates by automating all healthcare processes across various departments that have been launched by 2008. WAREED has linked more than 14 Ministry of Health (MoH) Hospitals and 25 clinics across the country targeting to avoid the dublication and improving patient safety with the mission of one patient and one record. According to the report of Frost and Sullivan (2012), The UAE healthcare market is expected to grow by 7% from 2015 to 2020. The UAE has

approved plans as well as a strategic roadmap to develop a national database of medical records to improve the quality of healthcare.

E-health and health informatics are set as key initiatives within the 5 year strategic healthcare development plan launched by 2014 (Health Authority Abu Dhabi, 2014). Based on the feedbacks of UAE healthcare professionals the government is investing in integrated healthcare information systems to improve the overall quality of care and ensure patients' health and safety in Emirates. Health Authority Abu Dhabi (HAAD) and Dubai Health Authority (DHA) are the two major healthcare authorities in the UAE working on structured programs as a part of the overall health strategy towards integrated health informatics and e-health through improved information exchange.

The interviews with Ministry of Health executives UAE, point the next top priority set as having ability to access and securely share a patient's vital medical information.

2.4.3 E-Health Initiatives in Egypt

The Government of Egypt and its Ministry of Health have established several e-health programs to bring better diagnostic and health services to a wider segment of the Egyptian society. Ministry of Information and Communication Technology (MCIT), has facilitated the integration of ICT in health services and the provision of medical education to remote or underserved areas of Egypt.

The e-health initiative is inspired by pursuing equal opportunities for health services anywhere in Egypt, and expanding medical insurance to all citizens (Ministry of Information and Communication Technology Egypt, 2016).

The principle objectives of the e-health initiative in Egypt are as follows:

- Extend better medical diagnostic services to rural areas
- Provide a training facility for the medical community
- Acquire international consultations for special cases
- Reduce the cost of health care through better patient management
- Optimize utilization of expertise and resources

- Provide advanced medical services in emergencies
- Create electronic databases for medical records *(ibid).*

The main components/projects of this initiative are (Ministry of Information and Communication Technology Egypt, 2016):

- Emergency Medical Call Center and Ambulance Service
- National Network for Citizen Health Treatment
- Information System Units in Governmental Hospitals
- National Healthcare Capacity Building Project
- Pilot Project for Hospital Automation
- Women's Mobile Health Unit Project
- National Cancer Registry Program
- The Suzanne Mubarak Center for Women's Health in Alexandria
- IT Health Master Plan
- National Picture Archiving and Communication Systems (PACS) Project
- Integrated National Health Record System

According to WHO: E-health Country Profiles Atlas (2011), Egypt has a national e-government and e-health policy.

E-health infrastructure development and developing the capacity of the healthcare force through training are supported by various public funding sources in the country *(ibid).*

2.4.4 E-Health Initiatives in Turkey

It is important to note that the health informatics was closer to an institutional level before the 'Healthcare Transformation Programme' had been launched in Turkey in 2003 (Yurt, 2008). This was the beginning of a new era in health informatics and e-Health, and institutional informatics projects have been replaced by more value added, and citizen centric e-health projects. E-health studies which are professionally conducted by the Turkish Ministry of Health are based on the studies on Turkey Health Information System Action Plan that began in 2003 and completed in January 2004. This plan was prepared as a result of a very intensive work with 10 separate working groups including governmental institutions, universities and non-governmental organizations. It can be said that the e-health

studies which are still underway, progresses in the framework of this document *(ibid).*To overcome the issue of quality data gathering the National Health Dictionary (HDD) was developed and published in 2007 in the scope of the e-Health strategy. There are 46 data sets and 261 data elements defined in the National Health Data Dictionary (Dogac et al., 2014, p.228).

The National Health Data Dictionary (NHDD) aims to ensure nation wide compatability and interoperability of health information systems in Turkey.

Family Medicine Information System (FMIS) has been the first successful implementation of e-health practices in Turkey.

The whole process of e-health is constructed under the umbrella of e-transformation in Turkey. The goal of the Ministry of Health is for, Turkey to build a National Health Information Web System Service, where all the services are based on open standards (Ministry of Health Turkey, Department of Health Informatics , 2016).

The other goal is to establish the electronic health records for more than 70 million Turkish citizens based on the expert interviews conducted by Turkish Ministry of Health, who are the healthcare informatics authorities in the country.

Sağlık.NET, is the conversion of the existing networks into a true health network platform providing linkages, services and big data such as electronic health records to the all stakeholders that are authorized in healthcare in the country. Sağlık.NET has been partially operational.

As a part of the National Health Systems, digital support systems to support advanced analysis of health sector based on EHR database (electronic health records) and telemedicine for remote health services have been among the initiatives of the Ministry of Health in Turkey. Teleradiology and telepathology have been other e-health practices that are encouraged by Ministry of Health in Turkey within the e-health strategy. In conclusion, Sağlık.Net aims to link and manage the network of hospitals, family doctors, clinics, pharmacies, specialized hospitals and labs with standards and protocols; Tools such as national health digital dictionary, decision support systems, health insurance integration , electronic health records, digital security systems which is e-signature for patient privacy and

data protection are key components for this network (Ministry of Health Turkey, Department of Health Informatics , 2016).

The Ministry of Health in Turkey defines " Sağlik.NET ” as an integrated, secure , fast and expandable information and communiccation platform, that aims to produce competent information for all the related stakeholders, by collecting the electronic produced data at the hospitals/clinics at the first, second and third level hospitals (Ministry of Health Turkey, Department of Health Informatics , 2016).

"Saglik.NET 2" is the platform where the data of family medicine information system and the data from the private hospitals , clinics and other healthcare entities that produce patient data are gathered. Therefore, it is an extended version of ‘Saglik.NET’.

Recently in 2015, the Ministry of Health in Turkey established a new online network for the Turkish Citizens called ‘e-nabiz’. This saglikNET online system provides the opportunity for the national citizens to access their personal health data by using their own e-signature (Ministry of Health Turkey, Department of Health Informatics , 2016).

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Research Design

This research is a field study, based on user insights to evaluate the challenges and expected outcomes of e-health implementation and utilization in a country. The sample group of this research is referred as ‘e-health users’ in this study. The study is built on three key pillars of approach and design:

To begin with, opinions of users and results presented in this research are based on in-depth interviews and answers given to the questionnaires presented in appendix A and appendix B.

There are three groups utilized as the sample within the scope of this study. The first group is the clinicians that are engaged with healthcare information systems in their hospitals and are key opinion leaders. The second group is the healthcare information technology (Healthcare IT) related professionals that are from these hospitals. The third group are the authorities/executives from the Ministry of Health of that country. The second and the third groups are named as ‘Healthcare IT Professionals’ in general within the scope of this study. Secondly, detailed user questionnaires are designed with closed and open end questions that have been preassessed and tested with a selected group of experts from healthcare professionals, who are engaged with e-health practices, to ensure the quality of data collected. The user questionnaires are conducted for this selected sample of clinicians and healthcare IT professionals. These questionnaires are analyzed to evaluate and understand the status, development challenges in e-health and related healthcare e-commerce initiatives and practices in that specific market. Additionally, within the scope of the study, secondary resources such as already exisiting market data with respect to healthcare infrastructure of that specific

market, ministry of health websites and public databases are used. The third pillar is the design of a model (Figure 2.1) analyzing the major e-health challenges and improvement components in that country. Judgemental sampling is utilized in this study. The first part of the sample is consisted of ten centers (hospitals) for each selected market. Five key opinion clinicians are selected per center to reply the Questionnaire I which is displayed in appendix A. In that way, fifty respondent sample of clinicians are analyzed per country.

In parallel, the second sample group that consisted of hospital healthcare information technologies (HCIT) professionals from selected hospitals as well as healthcare executives from Ministry of Health have responded to the Questionnaire II which is presented in appendix B. That group is summed to fifty-one respondents in total.

Therefore, in this research study a total of two hundred and fifty-one completed questionnaires are collected for analysis.

3.1.1 Selection of Research Countries

For the purpose of this field study four emerging countries; Turkey, United Arab Emirates, Kingdom of Saudi Arabia and Egypt are selected. The reason for selecting and comparing these countries, is primarily the similaries in the approach of governments for the development of e-health initiatives. These four countries have different level and extent of governmental e-health initiatives. Market accessability and gathering outcome-based data is key for any research study. Therefore, another criteria has been the access and ease of qualified data collection.

It is worthwhile qualifying what is referred by an emerging market and justify how the selected four countries match this definition and comply with the selection criteria requirements of this research study. Based on the “Market Classification Framework” conducted by Morgan Stanley Capital International (MSCI) published in June 2014, a market is evaluated on the following three criteria: economic development, size and liquidity and market accessibility (Morgan Stanley Capital International, 2014). This framework classifies markets into three major categories; frontier, emerging and developed. According to Financial Times Stock Exchange Group (FTSE), the market classification process includes an initial screening of

countries by their gross national income per capita, using World Bank data (FTSE Group Country Classification, 2014).

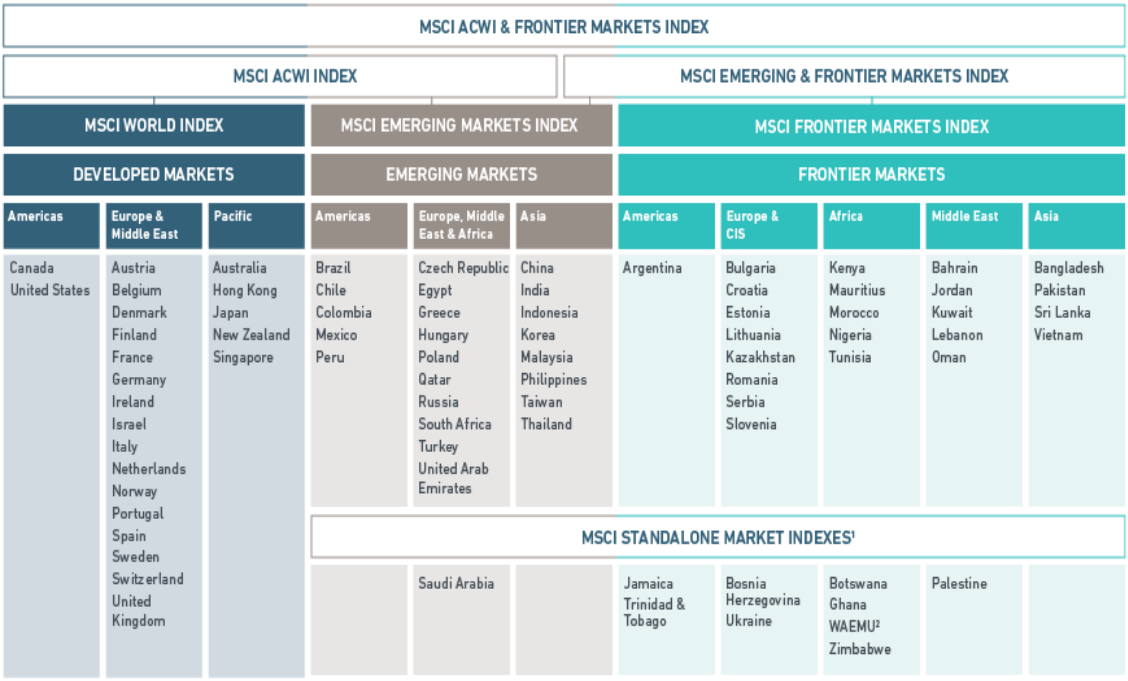
The MSCI Market Classification Framework, describes an emerging market as a country that has some characteristics of a developed market, but does not meet standards to be a developed market. This includes countries that may be developed markets in the future or were in the past. The term "frontier market" is used for developing countries with slower economies than "emerging". According to this framework the four largest emerging and developing economies by either nominal or PPP-adjusted GDP (purchasing power parity –adjusted gross domestic product) are the BRIC countries (Brazil, Russia, India and China) (Morgan Stanley Capital International, 2014).

The next five largest markets are South Korea, Mexico, Indonesia, Turkey, and Saudi Arabia, although South Korea is not considered as an emerging market by most sources (Morgan Stanley Capital International, 2014). Therefore, according to the global classification report of markets conducted by MSCI, UAE, Kingdom of Saudi Arabia, Turkey and Egypt are among emerging markets and are listed in the table 3.1.1 In that respect, this research study covers Turkey and Kingdom of Saudi Arabia as two major countries of interest where e-health initiatives are highly encouraged and supported by the governments. These two markets are expected to reach a certain maturity over five years regarding implementing e-health properly based on comments of government authorities.

On the other hand, it is worthwhile to mention that latest report of Financial Times Stock Exchange Group (FTSE) who is a British provider of stock market, presents Saudi Arabia under watch list and states it’s possible inclusion as secondary emerging market based on the prospective opening of the market to international institutional investors (FTSE Group Country Classification, 2015).

According to FTSE Group classification (FTSE, 2015), Turkey is an advanced emerging country whereas UAE, and Egypt are secondary emerging markets in the same geography. These two countries (UAE and Egypt) are also in the list of emerging markets for Morgan Stanley International market classification as presented in table 3.1.1 below;

Table 3.1.1 Morgan Stanley Capital International, Emerging and Frontier Markets Index
(Morgan Stanley Capital International, 2014)



3.1.2 Selection of Users

Since the aim of this study is to understand the current status as well as needs and gaps in e-health and e-commerce practices in selected markets based on customer insights in that target country, selection of users in other words, the interviewed stakeholders has been very crucial for getting qualified and contentful data for analysis and results. There have been numerous interviews carried with the governmental and ministry of health executives at high levels in selected markets; (Turkey, Kingdom of Saudi Arabia, UAE and Egypt) independent of conducting questionnaires in order to capture the status of e-health implementation practices as of today as well as qualifying the needs, hindering factors, action requirements and future plans. Another aim is to obtain a vision of prospective plans and targets to be achieved that would help in evaluating the user insights that have been provided by questionnaires conducted in that research. In order to have a homogeneous sampling there are three groups selected; '**Clinicians, Hospital Healthcare IT Professionals and Ministry of Health Executives**' that are also mentioned in paragraphs, above. For the first group of participants, clinicians are selected from large private hospitals that are a part of chain hospital groups with more than one hundred beds,

academic or university hospitals with one thousand and plus beds capacity and from public training hospitals with five hundred plus beds capacity. The clinicians are definitely the primary users at this stage to reflect their view with respect to e-health and health related e-commerce practices in their hospital and/or medical institute. That sample group of selected clinicians, consisted mostly of radiologists, interventionalists and cardiologists who need and use the digital imaging more frequently than other clinicians. The second group that was interviewed were hospital IT directors/managers who have been directly involved in these selected hospitals for managing any e-health related facilities. The third group that was interviewed were Ministry of Health Executives who are actively engaged in the implementation of e-health strategy and related programmes in the country.

3.1.3 User Questionnaires

The research is conducted by user questionnaires. A total of 251 e-health user questionnaires are collected for the analysis from these four selected countries. For each country 50 clinicians have replied the questionnaires. Additionally 15 healthcare IT professionals and Ministry of Health executives have also responded. The incomplete questionnaires are discarded of the statistical analysis. Two types of original questionnaires are used for the purpose of this research study. The questionnaires are prepared with the consultancy of some expert clinicians and healthcare IT professionals in the field of health informatics from the selected countries. The questionnaires are then tested with a selected group of healthcare professionals for the verification of the content, in order to maximize the outcomes of the questionnaires to reflect useful data for this study and guide for any future user insight related e-health study. Questionnaire I (presented in Appendix A), is directed to clinicians and it consists of eleven closed end questions with a final comment section. These questions mainly aim to identify the trust to e-business in healthcare, understand the status of use for e-health such as EHR and other healthcare IT practices in that hospital and qualify how effectively e-health practices are performed in that hospital. This is linked with the identification of major challenges of e-health development. In that respect, 'ICT infrastructure readiness, clinical cultural adaptation, regulations, financing and supply chain management and trust to patient privacy and big data use in healthcare' are given as

independent variables for the respondent to quality in a range from strongly agree to strongly disagree. The questionnaire also evaluates the insights of e-health users for the expected benefits of e-health in their country as well as the approach and perceptions of clinicians to healthcare e-commerce as a part of e-health practices. Questionnaire II (presented in Appendix B), is directed to hospital healthcare information technologies (HCIT) professionals and also to Ministry of Health executives.

It consists of eighteen closed-end questions. The content of questionnaire II is the same as the questionnaire I which is for clinicians except there are additional questions to identify and analyze in depth the big data use, the trends and opportunities of big data and efforts for measurement of e-health performance.

3.2 Research Methodology

3.2.1 Research Model

The preassessment in the field study has shown the essence of technology infrastructure and regulations with respect to compliant and effective use of e-health. Building trust for online e-business and cultural adaptation of related e-health stakeholders such as clinicians, other hospital staff and patients is equally reflected as strong contributors for e-health implementation and development. Many healthcare professionals have referred the significance of financing and supply chain management for e-health use and development. Although quite limited, the literature provides evidence supporting these arguments. Therefore, the framework of the model presented before in Figure 2.1 on page 37, is designed for assessing a country's e-health development and utilization capabilities based on user insights and literature review.

3.2.2 Research Hypotheses

Depending on the model stated the following hypotheses can be formulated:

H_1: ICT infrastructure and readiness has a positive effect on e-health development.

H_2: Cultural adaptation has a positive effect on e-health development.

H_3: Governmental regulations, policies and standards have positive effect on e-health development.

H_4: Financing and ease of payment have positive effect on e-health development.

H_5: Supply chain management has a positive effect on e-health development.

H_6: Trust on online business has a positive effect on e-health development.

Despite, the complex structure and multi dynamics of e-health where e-health refers all healthcare related e-business in the scope of this study, there are some key contributors to the proper implementation and better utilization of e-health capabilities in a country. As referred in above section the research model design is based on those preliminary literature reviews and expert views. Nonetheless some of those contributors are even more crucial then the others and their initiation would impact the others. Based on those initial findings the above six hypotheses are tested by regression analysis based on data gathered from user interviews. The following section details the testing and further analysis based on the hypotheses testing.

3.2.3 Hypotheses Testing

The six hypotheses stated, above (the independent variables H_1 to H_6), are tested for the dependent variable '**e-health development**' (Ho) with multiple regression analysis. To test the hypotheses, the 251 questionnaires answered by selected e-health users from those four selected countries are analyzed. The answered questionnaires are considered as one sample. E-health development has been the dependent variable (Ho) and to utilize this argument as a dependent variable there is a need for the minumum scale range. Therefore question 2 and question 3 in the questionnaires are used. Question 2 evaluates the use of e-health in that hospital /clinic. Question 3 further qualifies the effectiveness of the e-health use as presented in table 3.2.1.

Table 3.2.1 Question 3 of the Questionnaires : State of Use of E-health Practices

Not effectively at all	Not effectively	At average	Effectively	Very Effectively
1	2	3	4	5

In order to get the answers for the independent variables, question 4 of the questionnaires is used where the user is asked to give his opinion regarding the major drivers of a properly functioning e-health system. '**Infrastructure readiness for information and communication technologies, clinical cultural adaptation of related e-health users, governmental regulations and standards, financing**

and security of payment, supply chain management and trust' are the major drivers to be evaluated. The users have presented their view in a range from strongly disagree to strongly agree.

Table 3.2.2 Question 4 of Questionnaires : Major Drivers of E-health

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
ICT Infrastructure Readiness					
Clinical Cultural Adaptation					
Governmental Regulations and Standards					
Financing					
Supply Chain Management					
Trust					

The first step in the regression analysis is to interpret the ANOVA table in order to reveal whether the model is statistically significant or not. The ANOVA table of the regression analysis is as follows:

Table 3.2.3 ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Significance
	Regression	7,576	6	11,263	127,947	,001[b]
1	Residual	58,304	176	0,320		
	Total	65,880	182			

a.Dependent Variable e-health practices

b.Predictors: (Constant), Financing, ICT infrastructure readiness, clinical and cultural adaptation, trust, supply chain management, governmental regulations.

Since the significance (p value) of the model is 0,001 (F=123,947) and is smaller than 0,05 it can be concluded that the regression model is statistically significant. In other words, it is possible to explain the dependent variable "healthcare e-business development and implementation" by at least one of the independent variables. Collinearity may be one of the most important problems in multiple regression analysis.

Therefore before interpreting the results, it should be examined. In order to check for collinearity VIF values may be analyzed. As can be seen from the table all the VIF values are below 10 pointing out that there are no signals for collinearity.

Table 3.2.4 Analysis of Collinearity, Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3,687	1,285		4,869	,005		
	Regulatory	,207	,050	,270	4,124	**,035**	,230	1,034
	Supply chain mng.	,094	,158	,114	2,596	**,002**	,947	1,056
	Trust	,533	,053	,562	8,628	**,001**	,204	1,473
	Clinical and cultural adaptation	,098	,055	,136	3,055	**,000**	,260	1,845
	ICT Infrastructure readiness	,123	,061	,247	3,385	**,002**	,554	1,807
	Financing	,076	,064	,104	1,509	**,010**	,635	1,574

a. Dependent Variable: e-health practices

The above table also shows that, all of the significance values of independent variables are smaller than 0,05 which means that all of the hypotheses are accepted. The standardized coefficients or 'Beta coefficients' reveal the most effective variable on the dependent variable.

It can be stated that trust (Beta= 0,562) is the most effective variable on healthcare e-business development and implementation.

It is followed by governmental regulations (Beta= 0,270), ICT infrastructure readiness (Beta=0,247), clinical and cultural adaptation (Beta= 0,136), supply chain management (Beta=0,114) and payment/financing (Beta=0,104) consecutively.

The final results of the hypotheses test can be summarized as follows:

Table 3.2.5 Hypotheses Test; Final Results

Hypothesis	Variables	Significance (p value)	Result
H_1	ICT infrastructure and readiness--- healthcare e-business development/implementation	0,003	Accepted
H_2	Cultural adaptation---- healthcare e-business development/implementation	0,000	Accepted
H_3	Governmental regulations --- healthcare e-business development/implementation	0,037	Accepted
H_4	Financing --- healthcare e-business development/implementation	0,010	Accepted
H_5	Supply Chain Management --- healthcare e-business development/implementation	0,002	Accepted
H_6	Trust --- healthcare e-business development/implementation	0,001	Accepted

The final table of the regression analysis summarizes the model. From the table it is pointed out that the R^2 of the model is 0,499, stating that this model explains nearly 50% percent of the variation in healthcare e-business development and implementation.

In other words, the stated independent variables (trust, cultural adaptation, financing, regulations, ICT infrastructure and supply chain management) have an impact for e-health development in the selected countries. The related model summary table is as follows:

Table 3.2.6 Model Summary[b]

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	,644[a]	,499	,419	,38566

a. Predictors: (Constant), Payment/financing, trust, ICT infrastructure readiness, clinical and cultural adaptation, supply chain management, regulatory

b. Dependent Variable: e-health practices

To conclude this section and to proceed for further analysis in this research as mentioned and proved above all the hypothesis are accepted, meaning that as the independent variables increase the dependent variable will also increase. Hence if trust levels will improve, e-business applications will also improve. Similarly if governmental regulations and cultural adaptation will improve, e-business applications in healthcare will improve. Due to the fact that, as these factors will not improve, the challenges for e-business in healthcare will continue and the barriers for improvement will continue to exist. The model suggested above reflects that it can explain the core reasons up to 50% in the dependent variable which are essentially the challenges and barriers for improvement in e-business in healthcare. The percentage is favorable for a research study.

3.2.4 Analysis of Differences Between Countries

In order to reveal the differences between countries regarding independent variables, (besides testing the hypotheses), One –Way Anova test was conducted. The hypotheses pertaining to the Anova test are based on the assumption that there is a statistically significant difference between countries regarding importance of each independent variable. ICT infrastructure readiness, regulations and standards, trust, supply chain management, financing, clinical cultural adaptation are the independent variables. Therefore;

H_1: There is a statistically significant difference between countries regarding the importance of governmental regulations and policies. Before conducting the One-Way Anova test, it should be checked whether its precondition is satisfied or not. In other words, a test of homogenetiy of variances are tested via Levene statistic before applying the one-way anova test.

Table 3.2.7 Test of Homogeneity of Variances, Regulatory

Levene Statistic	df1	df2	Sig.
1,428	3	193	,252

P value (significance =,252) is greater than 0,05 pointing out that the variance of the groups are equal so there is no barrier to conduct the one-way anova test.

Table 3.2.8 ANOVA, Regulatory

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	137,373	3	45,791	32,995	,000
Within Groups	267,845	193	1,388		
Total	405,218	196			

As can be seen from the table above sig=0,00 that is smaller than 0,05. This signifies that H_1 is accepted. This means that there is a statistically significant difference between countries regarding the importance of **governmental regulations and policies.** In order to see between which countries that difference exists, post hoc tests are applied. The following table summarizes the results of the Scheffe test.

Table 3.2.9 Multiple Comparison, Dependent Variable; Regulatory, Scheffe

(I) Country	(J) Country	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
UAE	Egypt	,306	,238	,648	-,37	,98
	Turkey	-,118	,237	,969	-,79	,55
	KSA	-1,837*	,238	**,000**	-2,51	-1,17
Egypt	UAE	-,306	,238	,648	-,98	,37
	Turkey	-,424	,237	,363	-1,09	,24
	KSA	-2,143*	,238	**,000**	-2,81	-1,47
Turkey	UAE	,118	,237	,969	-,55	,79
	Egypt	,424	,237	,363	-,24	1,09
	KSA	-1,719*	,237	**,000**	-2,39	-1,05
KSA	UAE	1,837*	,238	,000	1,17	2,51
	Egypt	2,143*	,238	,000	1,47	2,81
	Turkey	1,719*	,237	**,000**	1,05	2,39

* The mean difference is significant at the 0.05 level.

Regarding the importance of governmental regulations and policies there is a difference between UAE and Saudi Arabia (sig=0,00), Egypt and Saudi Arabia (sig=0,00), Turkey and Saudi Arabia (sig=0,00) and finally Turkey and UAE (sig=0,00).

The further detailed information about the differences between groups (countries) can be analyzed by the group mean. This analysis is presented and stated in detail in the next chapter in results. For testing the second hypothesis the same steps mentioned above are followed.

H_2: There is a statistically significant difference between countries regarding the importance of supply chain management.

Table 3.2.10 Test of Homogeneity of Variances, Supply Chain Management

Levene Statistic	df1	df2	Sig.
6,241	3	179	,000

In the process of testing H_2 it can be seen that the precondition of one – way Anova is not satisfied. From the table above it can be noticed that the sig = 0,000 meaning that the variances of the groups for this variable are not homogeneous. In other words, the One Way Anova test can not be conducted in this case. Alternative to the One-Way Anova test Welch and Brown-Forsythe test which is one of the non-parametric tests can be applied. As this test is a non-parametric test it does not require preconditions.

Table 3.2.11 Robust Tests of Equality of Means, Supply Chain Management

	Statistic[a]	df1	df2	Sig.
Welch	10,249.	4.	78,996.	0,678.
Brown-Forsythe	7,486.	4.	144,896.	0,998.

a.Asymptotically F Distributed

From the table above it can be traced that the sig values are > 0,05 meaning that there are no statistically significant differences between countries regarding the importance given to **supply chain management** for effective e-health implementation. So H_2 is rejected. Next the third variable '**trust online business'** in healthcare is tested regarding statistically significant difference.

H_3: There is a statistically significant difference between countries regarding the importance of trust online business.

Table 3.2.12 Test of Homogeneity of Variances, Trust on Online Business in Healthcare

Levene Statistic	df1	df2	Sig.
,040	3	193	,989

As can be seen from the table the Levene Test signifies that the groups' variances for this variable are homogenous so that one-way anova test can be applied (sig=0,989 > 0,05).

Table 3.2.13 ANOVA, Trust on Online Business in Healthcare

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	111,828	3	37,276	39,344	,000
Within Groups	182,853	193	,947		
Total	294,680	196			

The results of the ANOVA test points out that the sig value=0,00 meaning that H_3 is accepted. In other words there are statistically significant differences between countries regarding the importance given to trust on online business.

In order to get detailed information on the source of the difference the Scheffe test is conducted. The results are summarized in the table 3.2.14 below;

Table 3.2.14 Multiple Comparisons, Dependent Variable: Trust on Online Business in Healthcare, Scheffe

(I) Country	(J) Country	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
UAE	Egypt	,000	,197	,000	-,55	,55
	Turkey	,462	,196	,137	-,09	1,01
	KSA	-1,531*	,197	,000	-2,09	-,98
Egypt	UAE	,000	,197	,000	-,55	,55
	Turkey	,462	,196	,137	-,09	1,01
	KSA	-1,531*	,197	,000	-2,09	-,98
Turkey	UAE	-,462	,196	,137	-1,01	,09
	Egypt	-,462	,196	,137	-1,01	,09
	KSA	-1,993*	,196	,000	-2,54	-1,44
KSA	UAE	1,531*	,197	,000	,98	2,09
	Egypt	1,531*	,197	,000	,98	2,09
	Turkey	1,993*	,196	,000	1,44	2,54

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

Regarding the importance of trust to online business in healthcare, there is a statistically significant difference between UAE and Egypt (sig=0,00), UAE and Saudi Arabia (sig=0,00), Egypt and Saudi Arabia (sig=0,00) and Turkey and Saudi Arabia (sig=0,00). The further detailed information about the differences between groups (countries) regarding '**trust to online business in healthcare'** can be analyzed by the group mean. This analysis is presented and stated in detail in the next chapter in results. Next the independent variable '**financing**' is tested to identify if there is any statistically significant difference between countries. Therefore;

H_4: There is a statistically significant difference between countries regarding the importance of financing, security and ease of payment.

Table 3.2.15 Test of Homogeneity of Variances, Financing

Levene Statistic	df1	df2	Sig.
32,974	3	193	,780

From the table above it can be seen that there is no barrier for the one-way anova test to be implemented because the preconditon of it is satisfied (Significance = 0,780).

Table 3.2.16 ANOVA, Financing

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	31,952	3	10,651	20,667	,588
Within Groups	99,459	193	,515		
Total	131,411	196			

The Anova results point out that there is no difference between coutries regarding the importance given to payment/financing facilities since sig=,588. In other words, H_4 is rejected. As the importance of '**clinical cultural adaptation**' is tested, to identify the differences regarding level of importance between selected countries;

H_5: There is a statistically significant difference between countries regarding the importance of clinical cultural adaptation.

Table 3.2.17 Test of Homogeneity of Variances, Clinical and Cultural Adaptation

Levene Statistic	df1	df2	Sig.
1,570	3	193	,198

P value (significance =,198) is greater than 0,05 pointing out that the variance of the groups are equal so that there is no barrier to conduct one-way anova test.

Table 3.2.18 ANOVA, Clinical and Cultural Adaptation

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	169,640	3	56,547	42,106	,000
Within Groups	259,192	193	1,343		
Total	428,832	196			

The Anova results point out that there is statistically significant difference between coutries regarding the importance given to clinical and cultural adaptation since sig=,000. In other words, H_5 is accepted.

Therefore, in order to qualify the statistically significant differences among countries, the Scheffe test is applied. According to the results of the scheffe test the mean difference is significant at the 0.05 level. This is presenting the statistical differences between the UAE and Turkey; UAE and Saudi Arabia; Egypt and Saudi Arabia and finally between Turkey and Saudi Arabia. As shown in table below, 3.2.19;

- UAE and Turkey (sig=0,00)
- UAE and Saudi Arabia (sig=0,00)
- Egypt and Saudi Arabia (sig=0,00)
- Turkey and Saudi Arabia (sig=0,00)

The detailed analysis of 'descriptive mean' for clinical cultural adaptation is presented in results, in the next chapter.

Table 3.2.19 Multiple Comparisons, Dependent Variable: Clinical and Cultural Adaptation, Scheffe

(I) Country	(J) Country	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
UAE	Egypt	-,347	,234	,534	-1,01	,31
	Turkey	-,025	,233	,000	-,68	,63
	KSA	2,000*	,234	,000	1,34	2,66
Egypt	UAE	,347	,234	,534	-,31	1,01
	Turkey	,322	,233	,592	-,33	,98
	KSA	2,347*	,234	,000	1,69	3,01
Turkey	UAE	,025	,233	,000	-,63	,68
	Egypt	-,322	,233	,592	-,98	,33
	KSA	2,025*	,233	,000	1,37	2,68
KSA	UAE	-2,000*	,234	,000	-2,66	-1,34
	Egypt	-2,347*	,234	,000	-3,01	-1,69
	Turkey	-2,025*	,233	,000	-2,68	-1,37

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

Finally '**ICT infrastructure readiness**' is tested to qualify if any statistical difference exists among selected countries regarding importance. Therefore;

H_6: There is a statistically significant difference between countries regarding the importance of ICT infrastructure readiness.

Table 3.2.20 Test of Homogeneity of Variances, ICT Infrastructure Readiness

Levene Statistic	df1	df2	Sig.
4,764	3	194	,883

P value (sig=,883) is greater than 0,05 pointing out that the variance of the groups are equal so there is no barrier to conduct one-way anova test.

Table 3.2.21 ANOVA, ICT Infrastructure Readiness

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	17,225	3	5,742	7,148	,000
Within Groups	155,830	194	,803		
Total	173,056	197			

As can be seen from the table above significance = 0,00 and that is smaller than 0,05. This signifies that H_6 is accepted. This means that there is a statistically significant difference between countries regarding the importance of ICT infrastructure readiness. In order to see between which countries that difference exist, post hoc tests are applied. The following table summarizes the results of the Scheffe test. As the table 3.2.22 presents, there is a statistically significant difference between UAE and Saudi Arabia (sig=0,01), also between UAE and Saudi Arabia, Egypt and Saudi Arabia (sig=0,08) and finally Turkey and Saudi Arabia (sig=0,03).

This means based on user insights the importance of **ICT infrastructure** is higher for e-health development for UAE , Turkey and Egypt compared to Saudi Arabia. This is detailed in results, in the next chapter.

Table 3.2.22 Multiple Comparison, Dependent Variable: ICT Infrastructure Readiness, Scheffe

(I) Country	(J) Country	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
UAE	Egypt	,090	,180	,969	-,42	,60
	Turkey	,040	,179	,997	-,47	,55
	KSA	,722*	,180	,001	,21	1,23
Egypt	UAE	-,090	,180	,969	-,60	,42
	Turkey	-,050	,180	,994	-,56	,46
	KSA	,633*	,181	,008	,12	1,14
Turkey	UAE	-,040	,179	,997	-,55	,47
	Egypt	,050	,180	,994	-,46	,56
	KSA	,682*	,180	,003	,17	1,19
KSA	UAE	-,722*	,180	,001	-1,23	-,21
	Egypt	-,633*	,181	,008	-1,14	-,12
	Turkey	-,682*	,180	,003	-1,19	-,17

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

In summary, the analysis presented in this section has demonstrated that financing and supply chain management are not statistically significant. This also implies that clinicians perceive those challenges less important than the other encountered problems. This analysis has also presented the clinicians' view on ranking the challenges of e-health in their country.

The challenges for e-health development are different for these selected countries regarding priority. In parallel a second group of participants for this study consisting of healthcare IT professionals and Ministry of Health executives have replied the questionnaires for evaluating the challenges of e-health in their country. This provided an opportunity to analyze and compare the different views of healthcare professionals and evaluate the results respectively. These comparative analysis are presented and discussed in detail in the next chapter.

CHAPTER 4

RESULTS OF THE STUDY

4.1 Testing the Model

This study presents a research model of a framework for assessing a country's e-health development requirements and related possible outcomes of this development, as well as utilization capabilities based on user insights. For the purpose of this research as explained in chapter 3, Turkey, UAE, Kingdom of Saudi Arabia and Egypt are the selected emerging markets for the study. These four countries have different levels and extend of governmental e-health initiatives. The questionnaires (Appendices A and B) are answered by judgementally selected key opinion leader doctors, healthcare IT professionals and ministry of health professionals that are either contributing or working on e-health initiatives in that country. These users were interviewed face to face. A total of two hundred and fifty-one (251) questionnaires were analyzed.

The research analysis is based on a distinctive model that evaluates the contribution and impact of '**Infrastructure and Communication Technologies**', '**Cultural Adaptation**', '**Government Regulations**', '**Policies and Standards**', '**Financing and Ease of Payment**', '**Supply Chain Management**' and '**Trust on E-business in healthcare**' based on user insights. The dependent variable '**e-health practices**' is tested for the 'financing, trust, infrastructure and communication technologies readiness (ICT Readiness), clinical and cultural adaptation, supply chain management and regulatory'. These are the predictors or in other words, the constant by regression analysis. The regression analysis has shown that the model built is statistically significant.

In other words, it is possible to explain the dependent variable e-health development and implementation by at least one of the independent variables. It can be stated that **trust (Beta= 0,562)** is the most effective variable on e-health development and

implementation requirements. It is followed by **governmental regulations where Beta is 0,270,** further **ICT infrastructure readiness (Beta= 0,247), clinical and cultural adaptation (Beta= 0,136), supply chain management (Beta= 0,114) and payment / financing (Beta= 0,104)** consecutively.

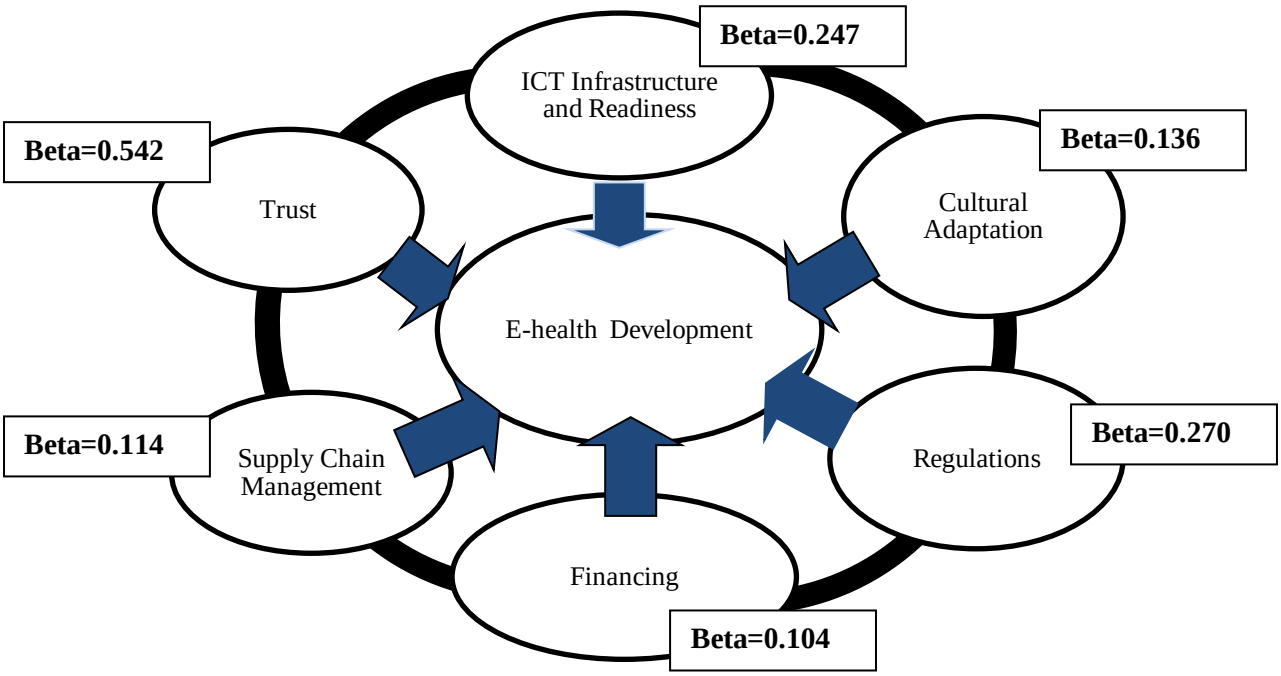


Figure 4.1 A Framework Model for Assessing E-health Development and Utilization Capabilities in a Country, Based on User Insights

4.2 Differences Between Selected Countries Based on User Insights

In order to reveal the statistical differences between countries regarding independent variables One –Way Anova tests are conducted.

'**Regulatory, trust to online e-business in healthcare, supply chain management, clinical cultural adapatation and ICT infrastructure readiness**' are the **independent variables**. The following hypotheses were tested.

The methodology of statistical tests are presented in detail in chapter 3, section 3.2.4 .There are six hypotheses tested;

H_1: There is a statistically significant difference between countries regarding the importance of governmental regulations and policies.

H_2: There is a statistically significant difference between countries regarding the importance of supply chain management.

H_3: There is a statistically significant difference between countries regarding the importance of trust online business in healthcare.

H_4: There is a statistically significant difference between countries regarding the importance of financing, security and ease of payment.

H_5: There is a statistically significant difference between countries regarding the importance of clinical/cultural adaptation.

H_6: There is a statistically significant difference between countries regarding the importance of ICT infrastructure readiness.

As it can be traced from the Welch and Brown- Forsythe test results presented in section 3.2.4, the sig values are > 0,05 meaning that there are no statistically significant differences between countries regarding the importance given to supply chain management for effective e-health implementation. Thus H_2 is rejected. As the table 4.2.1 below displays, the importance of governmental regulations and policies for Saudi Arabia doctors for efficient e-health development is higher when compared to doctors from UAE (Mean=3,94>2,10). The importance of governmental regulations for Saudi Arabia clinicians is also higher than the importance emphasized by the Egyptian (Mean=3,94>1,80) and also higher than the Turkish clinicians (Mean=3,94>2,22). There has been a significant difference between countries regarding the importance of 'trust to online business in healthcare' based on the pre statistical analysis presented in section 3.2.4 in chapter 3. The detailed results are presented by the table 4.2.2. below.

Table 4.2.1 Descriptives, Regulatory

	N	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
UAE	49	2,10	1,159	,166	1,77	2,43	1	5
Egypt	49	1,80	,957	,137	1,52	2,07	1	5
Turkey	50	2,22	,790	,112	2,00	2,44	1	5
KSA	49	3,94	1,638	,234	3,47	4,41	1	5
Total	197	2,51	1,438	,102	2,31	2,71	1	5

For Saudi doctors the importance regarding trust to online business in healthcare for efficient e-health systems is higher when compared to the UAE (Mean=2,22<3,65). It is also higher compared to Turkey (Mean=3,65>1,66) and Egypt ((Mean=3,65>2,12) as presented in table 4.2.2. On the other hand, it can be concluded from the results above, that for doctors from the UAE the importance of trust on online business in healthcare for efficient e-health systems is higher when compared to Egyptian doctors (Mean=2,22>2,12).

Table 4.2.2 Descriptives, Trust on Online Business in Healthcare

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
UAE	49	2,22	,971	,139	1,84	2,40	1	5
Egypt	49	2,12	,971	,139	1,84	2,40	1	5
Turkey	50	1,66	,939	,133	1,39	1,93	1	5
KSA	49	3,65	1,011	,144	3,36	3,94	1	5
Total	197	2,39	1,226	,087	2,21	2,56	1	5

When analyzing for H_4, with test of homogeneity of variances as presented in table 3.2.15 in chapter 3, there has been no barrier for One-Way Anova test to be implemented because the pre-conditon of it is satisfied (Sig=0,780). Therefore the Anova test was conducted.

The Anova results presented in table 3.2.16 in chapter 3, point out that there is no difference between coutries regarding the importance given to 'financing facilities' since sig=0,588. In other words, H_4 is rejected.

The multiple comparisons conducted by scheffe test resulted with a mean difference that is significant at the 0.05 level for H_5. Therefore regarding the importance of 'clinical and cultural adaptation' there is a statistically significant difference between countries.

From the descriptives table below one can conclude that for Turkish doctors the importance of clinical/cultural adaptation for efficient e-health systems is higher when compared to doctors from UAE (Mean=3,78>3,76). For doctors from the UAE the importance of clinical cultural adaptation for efficient e-health systems is

higher when compared to Saudi doctors (Mean=3,76<1,76). For Egyptian doctors, the importance of clinical cultural adaptation for efficient e-health systems is higher when compared to Saudi doctors (Mean=4,10>1,76). Finally one can comment that for Turkish doctors the importance of clinical cultural adaptation for efficient e-health systems in the country is higher when compared to Saudi doctors. (Mean=3,78 >1,76).

Table 4.2.3 Descriptives, Clinical and Cultural Adaptation

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
UAE	49	3,76	1,315	,188	3,38	4,13	1	5
Egypt	49	4,10	1,159	,166	3,77	4,43	1	5
Turkey	50	3,78	1,148	,162	3,45	4,11	1	5
KSA	49	1,76	,990	,141	1,47	2,04	1	5
Total	197	3,35	1,479	,105	3,14	3,56	1	5

The P value (significance=0,883) is greater than 0,05 pointing out that the variance of the groups are equal so there is no barrier to conduct one-way anova test for H_6 which analyzes if there is a significant difference between countries regarding the importance of the 'infrastructure and communication technologies readiness'. As can be seen from the Anova table conducted for the variable 'ICT infrastructure readiness' sig=0,00 that is smaller than 0,05. This signifies that H_6 is accepted.

This means that there is a statistically significant difference between countries regarding the importance of Information and Communication Technologies (ICT) infrastructure readiness. In order to see between which countries that difference exist, post hoc tests are applied. The results of the Scheffe test has shown that the mean difference is significant at the 0.05 level. From the below descriptives table when the means are analyzed it can be concluded that for doctors from UAE the importance of ICT infrastructure readiness for efficient e-health systems is higher when compared to Saudi doctors (Mean=2,60>1,88).

For Egyptian doctors the importance of ICT infrastructure readiness for efficient e-health systems is higher when compared to Saudi doctors (Mean=2,51>1,88). For

Turkish doctors the importance of ICT Infrastructure readiness for efficient e-health systems is higher when compared to Saudi doctors (Mean=2,56>1,88).

Table 4.2.4 Descriptives, ICT Infrastructure readiness

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
UAE	50	2,60	1,088	,154	2,29	2,91	1	5
Egypt	49	2,51	,845	,121	2,27	2,75	1	4
Turkey	50	2,56	,929	,131	2,30	2,82	1	5
KSA	49	1,88	,666	,095	1,69	2,07	1	3
Total	198	2,39	,937	,067	2,26	2,52	1	5

To conclude the results of this statistical analysis based on user perceptions and insights, there is a significant difference between countries regarding importance of predictors such as ICT infrastructure readiness, regulation, trust and cultural adaptation contributing to e-health development. Additionally, there is no significant difference between countries with respect to importance of supply chain management, financing, as well as security and ease of payment.

We can also conclude that for Saudi doctors the importance of governmental regulations and policies for efficient e-health systems is higher when compared to doctors from UAE (Mean=3,94>2,10), from Egypt (Mean=3,94>1,80) and from Turkish doctors (Mean=3,94>2,22).

Also for Saudi Arabia doctors the importance of trust on online business in healthcare for efficient e-health systems is higher when compared to UAE doctors (Mean=2,22<3,65), compared to Turkish doctors (Mean=3,65>1,66) and compared to Egyptian doctors (Mean=3,65>2,12).

It can be stated that the contribution of clinical cultural adaptation is perceived more important by Turkish and Egyptian doctors.

It can also be concluded that for doctors from UAE, Turkey, and Egypt, the importance of ICT infrastructure readiness for efficient e-health systems is higher when compared to Saudi doctors.

4.3 Comparative Country Analysis

4.3.1 Rank of E-health Challenges

The outputs of analysis from section 4.2, from analyzing the statistically significant differences between countries regarding e-health challenges, is further enriched with another analysis of data presenting the rank of challenges for e-health.

This ranking is dedicately based on the answers of healthcare IT (information technology) professionals and e-health related ministry of health authorities in that country. The question allowed the respondent to pick more than one priority which is the reason why the total percentages do not add up to hundred in total. The first two rankings are highlighted in the table.

As can be noticed from the table below, this analysis states clear concern around patient privacy, which is highly linked with regulatory policy and standards in the country as well as the security of the electronic healthcare data.

Table 4.3.1 Major Challenges of E-health Development;
Insights of Healthcare IT Professionals and Ministry of Health Executives

	UAE	EGYPT	TURKEY	KSA
ICT Infrastructure	**2 (70%)**	4 (47%)	5 (33%)	**1 (82%)**
Clinical Cultural Adaptation	**1 (80%)**	3 (53%)	4 (40%)	5 (36%)
Regulatory policy and standards	5(50%)	5 (33%)	3 (33%)	**2 (64%)**
(Governmental) reimbursement	7 (50%)	7 (40%)	7 (67%)	7 (36%)
Financial investment/facilities	6 (40%)	6 (23%)	6 (67%)	3 (46%)
Patient Privacy	3 (40%)	**1 (80%)**	**1 (68%)**	4 (27%)
Security of e-business/healthcare data	4 (30%)	**2 (40%)**	**2 (47%)**	6 (27%)

Patient privacy is ranked as the first major challange for proper e-health implementation for Egypt and Turkey, followed by security of e-business in healthcare referring especially to healthcare data like electronic health records.(EHR). Based on expert interviews it can be concluded that patient privacy and security of healthcare data are two parameters that are highly interconnected, which need to be regulated by governmental policy and standards. On the other hand, most of the respondents (80%) in UAE stated that clinical cultural adaptation

is the most important challenge followed by the readiness of the information and communication technologies infrastructure (ICT readiness) where ICT readiness is ranked as the biggest challenge followed by the regulatory policy and standards by Saudi Healthcare Professionals.

4.3.2 Outcomes of E-health

Another question that provides useful information to this study is based on analyzing the expected biggest positive impact and outcome if e-health is properly implemented and utilized in the country. The answers are evaluated separately for doctors and other healthcare professionals where other healthcare professionals refer to hospital IT Coordinators and Ministry of Health Executives as mentioned earlier in different sections of this study. The majority of the respondents still preferred to pick more than one answer for their different rankings. For this reason the total sum of the percentages do not add up to one hundred. Therefore, alternatively the 'Borda Count Method' is presented to pick the most voted answer. Even if the results of percentage ranking and Borda analysis are very relevant, Borda analysis is providing a much more accurate output. The top three percentage rankings are bolded as shown in the tables below. The results of the question for positive outcomes of e-health implementation according to the insights of hospital IT Coordinators and Ministry of Health Executives claim a common conclusion that efficiency, time and accuracy are the top three impacts.

Table 4.3.2.1 Analysis of Outcomes of E-health; Insights of Healthcare IT Professionals and Ministry of Health Executives

	UAE	**EGYPT**	**TURKEY**	**KSA**
Economical	4 (70%)	4 (80%)	4 (73%)	4 (67%)
Time	**2 (40%)**	**2 (33%)**	**2 (47%)**	**2 (36%)**
Efficiency	**1 (70%)**	**1 (67%)**	**1 (80%)**	**1 (67%)**
Accuracy	**3 (70%)**	**3 (53%)**	**3 (40%)**	**3 (46%)**
D2D (Doctor to doctor) Communication	6 (90%)	6 (80%)	6 (80%)	6 (73%)
P2D (Patient to doctor) Communication	5 (100%)	5 (73%)	5 (87%)	5 (78%)
Improve patient journey efficiency	7 (90%)	7 (73%)	7 (87%)	7 (64%)
Improve patient empowerment	8 (90%)	8 (93%)	8 (87%)	8 (91%)

Table 4.3.2.2 Analysis of Outcomes of E-health; Insights of Clinicians

	UAE	EGYPT	TURKEY	KSA
Economical	4 (72%)	4 (90%)	4 (64%)	4 (62%)
Time	**2 (56%)**	**2 (54%)**	**2 (30%)**	**3 (46%)**
Efficiency	**1 (84%)**	**1 (76%)**	**1 (72%)**	**1 (76%)**
Accuracy	**3 (46%)**	**3 (72%)**	**3 (44%)**	**2 (62%)**
D2D Communication	6 (80%)	6 (80%)	6 (70%)	6 (56%)
P2D Communication	5 (92%)	5 (94%)	5 (82%)	5 (64%)
Improve patient journey efficiency	7 (78%)	7 (74%)	7 (72%)	7 (40%)
Improve patient empowerment	8 (84%)	8 (72%)	8 (78%)	8 (44%)

The data for the analysis of the answers given by clinicians is presented above in table 4.3.2.2. According to the 84% of the doctors in UAE efficiency is the biggest positive impact of e-health implementation. Efficiency is followed by time. In other words 56% of the doctors in UAE pointed out that time is the second biggest impact of e-health implementation. Time is followed by accuracy, economical, patient to doctor communication (P2D communication), doctor to doctor communication (D2D communication) , improve patient journey efficiency and improve patient empowerment. In other words, according to 46% of the respondents accuracy is the third outcome of e-health implementation. 72% of the doctors stated that economical factors are the fourth important outcome of e-health implementation and for 92% of them patient to doctor Communication (P2D communication) is the fifth. While 80% of the doctors stated that doctor to doctor communication (D2D communication) is the sixth biggest impact of e-health implementation, 78% of the doctors pointed out that improving patient journey efficiency is the seventh biggest outcome. 84% of the doctors thought that improving patient empowerment is the least important outcome of e-health implementation.

For Egyptian and Turkish doctors the ranking of the outcomes are similar to the doctors in UAE. Only the percentages are different which can be seen from the table. However, there are some minor differences in Saudi doctors' ranking.

For Saudi doctors, again the most important outcome is efficiency. Yet in contrast to doctors in the UAE, Egypt and Turkey the Saudi doctors stated that accuracy is the second and accuracy is expected to be the third biggest positive impact of e-

health implementation. The rest of the rankings are similar to the doctors in other countries.

4.3.3 Use of an Alternative Ranking for Comparative Analysis: Borda Count Method

The ranking for comparative analysis is also conducted with Borda Count Method. The concept behind the Borda Count Method is to assign award points to candidates based on preference schedule, thus declaring the winner with the most points. According to Saari and Valognes (1998, p.243), over the last two centuries considerable attention has focussed on the properties of positional voting procedures. These commonly used approaches is assigning points to alternatives according to how each voter positions them. The Borda count (BC) assigns n-1, n-2, …th, n-n=0 points, respectively, to a voter's first, second and further nth ranked candidate. This research study allowed the respondents to make more than one choice in their ranking. Therefore the Borda Count Method is also used to clarify the highest ranking among choices.

As clarified in the Borda method, if N is the number of candidates, each first-place vote is worth N points. Then, each second-place vote is worth N − 1 points. Each third-place vote is worth N − 2 points. Each Nth-place, (for example last-place), vote is worth 1 point. Whichever candidate receives the most points wins the election.

The Borda method is applied for the question; 'Analysis of Outcomes of E-health in the Country'. The question is replied both by 'clinicians and healthcare IT professionals'. There are eight criteria to be listed on this above question. The first criterion gets 8 points, second 7 points, third 6 points, fourth 5 points, fifth 4 points, sixth 3 points, seventh 2 points and the eighth one points. The Borda Count method is considerably lengthy and therefore, only the results are presented.

The detailed calculations of Borda Count Method for the 'analysis of outcomes of e-health', is demonstrated in Appendix C to Appendix F of this study.

The Borda method results, based on the 'Insights of clinicians and Healthcare IT Professionals' with respect to the 'expected outcomes of e-health' are as follows:

Table 4.3.3.1 Outcomes of E-health: Borda Analysis, UAE Clinicians

Criterion	**Points**
Economical	264
Time	**343**
Efficiency	**389**
Accuracy	**301**
D2D Communication	135
P2D Communication	196
Improve Patient Journey Efficiency	111
Improve Patient Empowerment	61

So for the doctors from UAE the biggest positive impact of e-health implementation is efficiency followed by time and accuracy. The results show that, the views of Healthcare IT Professionals for 'the expected outcomes of e-health implementation in UAE' are also aligned with the UAE clinicians as presented in table 4.3.3.2 below;

Table 4.3.3.2 Outcomes of E-health: Borda Analysis, UAE Healthcare IT Professionals

Criterion	**Points**
Economical	53
Time	**70**
Efficiency	**77**
Accuracy	**60**
D2D Communication	28
P2D Communication	40
Improve Patient Journey Efficiency	21
Improve Patient Empowerment	11

As demonstrated in table 4.3.3.3 below, for the doctors from Egypt the biggest positive impact of e-health implementation is efficiency followed by time, accuracy,

economical, then followed by patient to doctors communication and further with doctor to doctor communication.

Table 4.3.3.3 Outcomes of E-health: Borda Analysis, Egyptian Clinicians

Criterion	**Points**
Economical	**250**
Time	**342**
Efficiency	**381**
Accuracy	**301**
D2D Communication	131
P2D Communication	**194**
Improve Patient Journey Efficiency	98
Improve Patient Empowerment	67

As table 4.3.3.4 below, presents according to Egyptian Healthcare IT Professionals efficiency, time and accuracy are the most important expected outcomes of e-health for Egypt. The insights of 'Egyptian Healthcare IT Professionals' are aligned with the views of Egyptian clinicians.

Table 4.3.3.4 Outcomes of E-health: Borda Analysis, Egyptian Healthcare IT Professionals

Criterion	**Points**
Economical	**79**
Time	**105**
Efficiency	**115**
Accuracy	**91**
D2D Communication	44
P2D Communication	55
Improve Patient Journey Efficiency	35
Improve Patient .Empowerment	16

For the clinicians from Turkey, the biggest positive impact of e-health implementation is efficiency followed by time, accuracy, economical and patient to doctor communication. This is presented in table 4.3.3.5 below.

Table 4.3.3.5 Outcomes of E-health: Borda Analysis, Turkish Clinicians

Criterion	**Points**
Economical	**270**
Time	**334**
Efficiency	**386**
Accuracy	**297**
D2D Communication	155
P2D Communication	**203**
Improve Patient Journey Efficiency	96
Improve Patient Empowerment	64

Table 4.3.3.6 Outcomes of E-health: Borda Analysis, Turkish Healthcare IT Professionals

Criterion	**Points**
Economical	79
Time	**103**
Efficiency	**117**
Accuracy	**91**
D2D Communication	43
P2D Communication	58
Improve Patient Journey Efficiency	30
Improve Patient Empowerment	19

Table 4.3.3.6 above, presents that according to the Turkish Healthcare IT Professionals efficiency, time and accuracy are the most important expected outcomes of e-health in Turkey. This view is aligned with the Turkish clinicians insights.

Table 4.3.3.7 Outcomes of E-health: Borda Analysis, Saudi Clinicians

Criterion	**Points**
Economical	**199**
Time	**235**
Efficiency	**311**
Accuracy	**265**
D2D Communication	110
P2D Communication	152
Improve Patient Journey Efficiency	70
Improve Patient Empowerment	59

For the doctors from Saudi Arabia, the biggest positive impact of e-health implementation is efficiency followed by accuracy, time, economical and patient to doctor communication. As table 4.3.3.8 below, demonstrates the Saudi Healthcare IT Professionals foresee efficiency, time and accuracy as the most important expected outcomes of e-health for Kingdom of Saudi Arabia.

Table 4.3.3.8 Outcomes of E- health: Borda Analysis, Saudi Healthcare IT Professionals

Criterion	**Points**
Economical	**61**
Time	**66**
Efficiency	**84**
Accuracy	**66**
D2D Communication	31
P2D Communication	46
Improve patient journey efficiency	30
Improve patient empowerment	12

Therefore, the following statements can be concluded from the analysis above:

Both doctors and other healthcare professionals have a consensus that implementing e-health in the country will improve efficiency as well as accuracy in the workflow of

the healthcare system. It will also impact time management positively which will all have an expected positive outcome for the economy. The results also reflect that patient to doctor communications will positively improve which would affect patient empowerment and the overall patient journey.

4.4. User Approach to Healthcare E-commerce and User Buying Criteria

This study also aimed to understand the approach and views of customers to E-commerce in healthcare. In that respect the buying behaviour of customers and their requirements for utilizing E-commerce, in their healthcare transactions are evaluated and analyzed. The following table presents the answer to the question regarding the use of e-commerce in healthcare or medicine in general, but highly referring to the purchase of pharmaceuticals;

Table 4.4.1 Healthcare E-Commerce: User Online Buying Behaviour /Pharmaceuticals

	UAE*		**Egypt***		**Turkey**		**KSA**	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes	2%*	1	---	---	---	---	2%	1
No	96%*	48	98%*	49	100%	50	98%	49
Partially	---	---	---	---	---	---	---	---

First of all, it is important to note that one of the respondents in UAE and Egypt did not answer this question. For this reason the calculation of percentages were done over 98% instead of 100% (one respondent represents 2% of the whole).

From the table above, it can be concluded that in all of the countries where the research was conducted most of the doctors state that they do not use healthcare e-commerce practices in medicine. In the UAE and Saudi Arabia, only one doctor stated that he/she used healthcare e-commerce practices in medicine. On the other hand in Turkey and Egypt all the respondents pointed out that they did not use healthcare e-commerce practices in medicine. This question is formulated more spesific around the e-commerce practices for diagnostic devices and the following results are obtained:

Table 4.4.2 Healthcare E-commerce, User Online Buying Behaviour/Diagnostic Devices

	UAE		Egypt*		Turkey		KSA	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes								
No	100%	50	96%*	48	100%	50	100%	50
Partially	---	---	---	---	---	---	---	---

It should be noted that two of the Egyptian doctors did not answer this question. Therefore calculations pertaining to Egypt were done over 96% instead of 100% due to the missing data (4%).

The table above states that in all of the four countries the results are approximately similar pointing out that most of the doctors said that they do not use e-commerce practices for diagnostic devices. For instance, among the respondents 100% of them in UAE, Saudi Arabia and Turkey declared that they do not use E-commerce practices for diagnostic devices. In fact it is the same for the Egyptian doctors when the two missing responses are not considered.

The analysis has been extended with questions to understand if any healthcare supply purchases are done for consumables, reusables and portable devices in healthcare. The following table presents the related results:

Table 4.4.3 Perceptions of Clinicians for Online Supply of Healthcare Consumables

	UAE		Egypt*		Turkey		KSA	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes							2%	1
No	100%	50	98%*	49	100%	50	98%	49

It should be noted that one of the Egyptian doctors did not answer this question. Therefore calculations pertaining to Egypt were done over 98% instead of 100%

because of missing data (2%). As can be seen from the table 100% of the respondents in UAE and Turkey stated that they did not make any healthcare supply puchases online.

The result is similar for Egypt when the missing data is not considered. In other words, among 49 of the respondents all of them stated that they had not made any healthcare supply purcahses online before. Fort he Saudi Arabia sample the scores are slightly different. Only one of the respondents pointed out that he/she had made healthcare supply purchases online. Similar questions are raised to Healthcare IT Coordinators and Ministry of Health executives to further investigate the online approach for supply of healthcare essentials, and consumables. Their answers are plotted below:

Table 4.4.4 Perceptions of HCIT Professionals for Online Supply of Healthcare Consumables

	UAE		**Egypt**		**Turkey***		**KSA**	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes	---	---	---	---	13,3%	2	---	---
No	90%	9	100%	15	66,7%	10	100%	11
Sometimes	10%	1	---	---	13,3%	2	---	---

It should be noted that one of the respondents in Turkey did not answer this question. Therefore, the calculation of percentages were done over 93,3% instead of 100%. The results show that the hospital healthcare IT coordinators and ministry of health executives also reflect that there exists almost none for the online healthcare purchases. In other words, only a very low percent e-commerce transactions happen in Turkey and UAE. In order to qualify which healthcare products are bought online, a further question asked to the same group of respondents has reflected the following results. It should also be noted that one of the respondents in Turkey did not answer this question. Therefore, the calculation of percentages were done over 93,3% instead of 100%. The results of the anwers and the one to one interviews showed that today it is only somewhat pre-approved, and routinely used consumables are purchased online by some hospitals in Turkey and UAE .

Table 4.4.5 Country Comparison: User Approach in Healthcare E-commerce

	UAE		Egypt		Turkey*		KSA	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Consumab-les	10%	1	---	---	33,3%	5	---	---
Equipment	---	---	---	---	---	---	---	---
NA	90%	9	100%	15	60%	9	100%	11

This study investigates the buying behavior criteria as mentioned in above paragraphs. In that aspect the customers in the selected sample are asked to rank their requirements when they purchase a diagnostic system. The respondents have assigned more than one choice in their ranking as reflected in the below table which has been further analyzed with the borda method to have a more precise result for interpretation.

Table 4.4.6 Healthcare E-commerce: Buying Criteria of Users for Diagnostic Devices, UAE

1st Rank	**2nd Rank**	**3rd Rank**	**4th Rank**	**5th Rank**
Latest Technology (76%)	Quality (52%)	Price (56%)	Aftersales Service (48%)	Aftersales Service (32%)
D2D Advice (16%)	D2D Advice (14%)	Quality (24%)	Price (26%)	Payment Facility (30%)
Quality (8%)	Latest Technology (10%)	Latest Technology (8%)	Quality (10%)	Partnership (20%)

The 76% of the doctors from the UAE put latest technology in the first rank. D2D advice is ranked as the most important requirement by the 16% of the respondents in this country, followed by quality. In other words, quality is the most important requirement for 8% of the doctors. Most of the respondents (52%) ranked quality as the second important requirement when they are buying a diagnostic system.

While 14% of the respondents stated that D2D advice is the second most important factor, 10% of them said that latest technology ranked secondly. According to the

56% of the respondents in the UAE price, for the 24% of the respondents quality is the third most important requirement.

On the other hand, 48% of the doctos who responded to the questionnaire stated that aftersales service rank is the forth most important factor in buying a diagnostic system. 26% of the doctors responded that price is the forth most important factor, while 10% of them stated that quality is the forth most important driver. According to most of the respondents (32%), aftersales service is the fifth most important issue in buying a diagnostic system. Almost another high percentage of doctors (30%) participated in the survey pointed out that payment facility ranks fifth.

Table 4.4.7 Healthcare E-commerce: Buying Criteria of Users for Diagnostic Devices, **Egypt**

1st Rank	**2nd Rank**	**3rd Rank**	**4th Rank**	**5th Rank**
Latest Technology (54%)	Quality (48%)	Price (42%)	Aftersales Service (36%)	Partnership (28%)
Technical Information (28%)	Price (26%)	D2D Advice (16%)	Payment Facility (14%)	Payment Facility (22%)
Quality (24%)	Ease of Use (20%)	Aftersales Service (14%)	Price (12%)	Warranty (16%)

When the scores of UAE and Egypt are compared both similarities and differences can be traced. To begin with, starting from the similarities, latest technology (54% of the respondents stated) ranked as the most imporant factor in buying a diagnostic system. It is followed by quality (48%), price (42%), aftersales services (36%) and partnership (28%).

The first four ranking remained same in the Egptian scores while 28% of the respondents stated that partnership is the fifth most important factor. As a difference, the percentages of the respondents changed when compared with UAE. There are also differences in the minor rankings. For instance, at the first rank other than latest technology it can be seen that technical information and quality is also stated as the first important factor.

Similarly, at the second rank other than quality, price and ease of use are mentioned as the second most important factor in buying a diagnostic system. Again it can be noticed that, other than price, D2D advice and aftersales service are stated as the third most important factor. According to the doctors other than aftersales service, payment facility and price can be considered as the fourth most important issue in buying a diagnostic system, and they stated that partnership, payment facility, and warranty may be the fifth most important factor.

Table 4.4.8 Healthcare E-commerce: Buying Criteria of Users for Diagnostic Devices, **Turkey**

1st Rank	**2nd Rank**	**3rd Rank**	**4th Rank**	**5th Rank**
Latest Technology (38%)	Quality (26%)	Price (24%)	Price (16%)	Partnership (26%)
D2D Advice (36%)	Latest Technology (24%)	Partnership (16%)	Aftersales service (14%)	Aftersales service (16%)
Technical Information (26%)	D2D Advice (18%)	Payment Facility (16%)	Ease of use(12%)	Price (10%)

When Turkey scores for question eight are examined it can be said that the major ranking remains similar with UAE and Egypt. In other words, most of the doctors (38%) ranked latest technology as the most important factor in buying diagnostic system. 26% of the Turkish respondents stated that quality is the second most important factor. According to the most of the respondents (24%) price is the third important issue. Finally 26% of the Turkish respondents stated that partnership is the fifth factor regarding importance in buying diagnostic system. The factor that sets aparts Turkey's scores on this question is the low level of percentages displayed on the table above. For instance as the forth most important factor, it is said that price was set by the 16% of the doctors. This 16% may mean that rest of the doctors stated different factors as the fourth factor. This is very similar for the other rankings. For example, in the Egpyt score table it can be said that quality is the second important factor by 48% of the respondents. It is the same in the Turkish

sample, however only 26% of the respondents stated that it is the second most important factor. This may be explained as the other respondents stated different factors for these rankings.

Table 4.4.9 Healthcare E-commerce: Buying Criteria of Users for Diagnostic Devices, Kingdom of Saudi Arabia

1st Rank	**2nd Rank**	**3rd Rank**	**4th Rank**	**5th Rank**
D2D Advice (52%)	Ease of Use (36%)	Latest Technology (34%)	Price (28%)	Partnership (40%)
Quality (40%)	Latest Technology (28%)	Price (20%)	Latest Technology (16%)	Price (18%)
Ease of Use (30%)	D2D Advice (24%)	Ease of Use (14%)	Quality (10%)	Aftersales Service (6%)

52% of the Saudi doctors chose doctor to doctor advice in the first rank. Quality is ranked as the most important requirement by the 40% of the respondents in this country.It is followed by ease of use. In other words, ease of use is the most important requirement for 30% of the doctors. Most of the respondents (36%) ranked ease of use as the second most important requirement when they are buying a diagnostic system. While 28% of the respondents stated that latest technology is the second most important factor, 24% of them said that doctor to doctor advice ranked secondly.

According to the 34% of the Saudi respondents latest technology, for the 20% of the respondents price is the third most important requirement. On the other hand, 28% of the doctos who responded to the questionnaire stated that price ranks as the forth most important factor in buying a diagnostic system. 16% of the doctors responded that latest technology is the forth most important factor, while 10% of them stated that quality is the forth important driver.

According to the most of the respondents (40%), partnership is the fifth most important issue in buying a diagnostic system. 18% of the doctors who participated in the survey pointed out that price ranks fifth. When the Borda method is applied

to provide a different perspective for the 'healthcare e-commerce user buying criteria for diagnostic devices' percentage rankings above, the following results as presented in table 4.4.10 to table 4.4.13 below, are achieved:

Table 4.4.10 Healthcare E-commerce, Borda Analysis;
Buying Criteria of Users for Diagnostic Devices, UAE

Criterion	**Points**
D2D Advice	77
Tech. Information	17
Latest Technology	222
Detailed Website	0
Ease of Use	39
Product Presentation	0
Warranty	6
Application	4
Aftersales Service	75
Price	133
Choice	15
Quality	172
Payment Facility	19
Partnership	10
Financing	5
Security of e-commerce site	0

Hence as the borda count method reflects clearly for UAE users price , quality and technology are their top priority when buying a diagnostic healthcare system. It can be remarked that aftersales service and further doctor to doctor advise also have crucial impacts during the decision cycle.

This ranking is infact presenting similarity with the analysis based on percentage ranking presented in table 4.4.6. Table 4.4.6 is also pointing that most of the users have placed price, quality and technology as their top three decision criteria.

Table 4.4.11 Healthcare E-commerce, Borda Analysis;
Buying Criteria of Users for Diagnostic Devices, Egypt

Criterion	**Points**
D2D Advice	83
Technical Information	110
Latest Technology	170
Detailed Website	0
Ease of Use	104
Product Presentation	3
Warranty	22
Application	24
Aftersales Service	62
Price	128
Choice	0
Quality	174
Payment Facility	37
Partnership	27
Financing	13
Security of E-commerce Site	1

Even if total points are different from each other, the Borda Count Method shows that similar to UAE price, quality and having the latest technology are top three rankings for the Egyptian customers when they buy a diagnostic healthcare system.

The percentage ranking presented in table 4.4.7 is in allignment with the results of the above Borda analysis.

Hence for Egyptian users quality, price, latest technology, technical information and ease of use are crucial factors when buying a diagnostic device.

Table 4.4.12 Healthcare E-commerce, Borda Analysis;
Buying Criteria of Users for Diagnostic Devices, Turkey

Criterion	**Points**
Doctor to Doctor Advice	161
Tech. Info.	116
Latest Technology	152
Detailed Website	23
Ease of Use	94
Product Presentation	31
Warranty	39
Application	53
Aftersales Service	70
Price	117
Choice	40
Quality	172
Payment Facility	39
Partnership	88
Financing	10
Security of e-commerce site	9

For Turkish users quality, technology, and doctor to doctor advice are the most crucial criteria for their buying decisions. The above table states that price, ease of use and partnership are other crucial factors impacting the buying decisions of Turkish users.

The percentage ranking of users for their buying criteria, is slightly different than the Borda analyis. The percentage ranking of Turkish users presented in 4.4.8 also highlight quality and price.

Saudi users, as can be noted from below table, rank doctor to doctor advice, ease of use, and quality as the top three most important factors when making their decision to buy a diagnostic healthcare system.

Table 4.4.13 Healthcare E-commerce, Borda Analysis;
Buying Criteria of Users for Diagnostic Devices, Kingdom of Saudi Arabia

Criterion	**Points**
Doctor to Doctor Advice	201
Tech. Information	3
Latest Technology	142
Detailed Website	2
Ease of Use	179
Product Presentation	0
Warranty	0
Application	7
Aftersales Service	16
Price	83
Choice	2
Quality	155
Payment Facility	1
Partnership	40
Financing	11
Security of E-commerce Site	13

The percentage ranking of Saudi users presented in table 4.4.9 is aligned with the results of Borda analysis. The Borda Analysis of Saudi users as presented in table 4.4.13 above is additionally stating the essence of technology and price for Saudi users.

Buying behaviour is further analyzed for specific healthcare e-commerce requirements, that users would look at, regarding their future decisions on a healthcare website. A question is asked to the users to clarify their most important criterion (their top five requirements) if they buy online healthcare products and /or healthcare services. The results of the clinicians for the top five requirements for the selected countries are as follows:

Table 4.4.14 Top Five Requirements for Healthcare E-commerce in the Future; Clinicians' Insights

	UAE	**EGYPT**	**TURKEY**	**KSA**
Reputation of the supplier		2 (38%)	1 (78%)	1 (46%)
E-commerce site ease of use and facilities				
Delivery (supply chain management)	4 (38%)	4 (20%)		5 (34%)
Payment security	1 (92%)	1 (52%)	2 (32%)	
Choice of recontact with the supplier	5 (44%)	5 (50%)	5 (34%)	4 (32%)
Price	3 (64%)		4 (34%)	3 (26%)
Quality	2 (60%)	3 (42%)	3 (32%)	2 (44%)
Application option				
Payment/financing				

According to the 92% of the doctors in the UAE payment security is the most important criterion if they buy online via health e-commerce. 60% of these doctors stated that quality is the second most important factor followed by the price. In other words, 64% of the doctors in UAE pointed out that price is the third most important criterion if they buy online via health e-commerce. Price is followed by delivery (38%) and choice of recontact with the supplier (44%) respectively.

For Egyptian doctors the most important criterion when they are buying online via health e-commerce is payment security (52%). This result is similar with the UAE ranking. Differentiating than the UAE, 38% of the Egyptian doctors stated that the second important criterion is the reputation of the supplier. Reputation of the supplier is followed by quality (42%), delivery (20%) and and choice of recontact with the supplier (50%).

On the other hand, most of the doctors (78%) in Turkey stated that reputation of the supplier is the most important factor. This result is totally different than the rankings in the UAE and Egypt. The reputation of the supplier is followed by payment security (32%), quality (32%), price (34%) and choice of recontact with the supplier (34%) respectively.

Similarly 46% of the Saudi doctors rank reputation of the supplier as the most important factor. This is followed by quality (44%), price (26%), choice of recontact with the supplier (32%) and delivery (34%).

The same question has been raised to healthcare professionals and executives from Ministry of Health and selected hospitals including the Healthcare IT Coordinators of the selected hospitals. The frequency output is plotted below:

Table 4.4.15 Top Five Requirements for Healthcare E-commerce in the Future; Healthcare IT Professionals' Insights

	UAE	**EGYPT**	**TURKEY**	**KSA**
Reputation of the supplier	7 (40%)	6 (40%)	7 (40%)	7 (18,2%)
E-commerce site ease of use	4 (30%)	7 (40%)	5 (26,7%)	5 (18,2%)
Delivery	3 (30%)	2 (40%)	4 (40%)	2 (36,4%)
Payment security	2 (30%)	1 (80%)	1 (40%)	6 (9,1%)
Choice of recontact with the supplier	5 (30%)	3 (40%)	3 (20%)	4 (36,4%)
Price	6 (40%)	4 (26,7%)	6 (20%)	3 (45,5%)
Quality	1 (70%)	5 (33,3%)	2 (33,3%)	1 (45,5%)
Application Option	8 (20%)	8 (26,7%)	9 (6,7%)	8 (18,2%)
Payment/Financing Facilities	9 (20%)	9 (33,3%)	8 (13,3%)	9 (18,2%)
Others, please specify				

The above table reflects a slight difference regarding the point of view of Healthcare IT Coordinators and Ministry of Health Executives referring also to the significance of delivery in their top three requirements for healthcare e-commerce transactions in UAE. Whereas for Egypt there is a similar response of ranking delivery as number two and also pointing the essence of the choice of recontact with the supplier.

The responses of Turkey's Ministry of Health executives as well as selected hospital IT Coordinators, mention the need for recontact with the supplier, quality and payment security in their top three rankings. Finally the Saudi Arabia, Ministry of Health executives and selected hospital IT Coordinators highlighted delivery, price and quality in their top three rankings for prerequisites regarding their preferences for healthcare e-commerce to be functional in their possible future

healthcare transactions. Those top three rankings from the Saudi healthcare IT professionals are different than the Saudi doctors emphasing quality, reputation of the supplier and price as the three most important e-commerce criteria.

When the Borda Count Method is applied to support and clarify the ranking interpretation of above analysis, it can be seen that payment security, quality and price are the top three requirements for UAE customers if they buy online for healthcare products. Delivery, reputation of the customer and possibility to get back to the customer are also in the top five ranking in decision criteria.

Table 4.4.16 Healthcare E-commerce, Borda Analysis;
Top Five Requirements for Healthcare E-commerce in the Future, UAE Results

Criterion	**Points**
Reputation of The Supplier	56
E-Commerce Site Ease of Use	4
Delivery	87
Payment Security	246
Choice of recontact with the supplier	50
Price	138
Quality	184
Application Option	0
Payment	3

The below table reflects that for Egyptian customers payment security, reputation of the supplier and quality are the top three priorites in their decisions when they are asked for healthcare e-commerce requirements in their possible future transactions.

Table 4.4.17 Healthcare E-commerce, Borda Analysis;
Top Five Requirements for Healthcare E-commerce in the Future, Egypt Results

Criterion	**Points**
Reputation of The Supplier	190
E-Commerce Site Ease of Use	16
Delivery	69
Payment Security	207
Choice of recontact with the supplier	49
Price	97
Quality	161
Application Option	9
Payment	7

Turkish customers have highlighted reputation of the customer, payment security and quality as the top three requirements for their healthcare E-Commerce transactions.

Table 4.4.18 Healthcare E-commerce, Borda Analysis;
Top Five Requirements for Healthcare E-commerce in the Future, Turkey Results

Criterion	**Points**
Reputation of The Supplier	232
E-Commerce Site Ease of Use	40
Delivery	84
Payment Security	153
Choice of recontact with the supplier	76
Price	73
Quality	131
Application Option	39
Payment	19

Finally the table below with respect to Saudi users shows similar outcomes to Turkish users emphasizing on reputation of the supplier, payment security and quality as the top three ranking in healthcare e-commerce decisions followed by price and choice of recontact with the supplier.

Table 4.4.19 Healthcare E-commerce, Borda Analysis;
Top Five Requirements for Healthcare E-commerce in the Future, Saudi Arabia Results

Criterion	**Points**
Reputation of The Supplier	211
E-Commerce Site Ease of Use	1
Delivery	45
Payment Security	144
Choice of recontact with the supplier	81
Price	113
Quality	177
Application Option	3
Payment	12

Within the scope of this study, it is also analyzed if 'E-commerce' is perceived as a necessity for healthcare by customers. The results are displayed in table 4.4.20.

Table 4.4.20 Evaluation of a Need for Healthcare E-Commerce; Clinicians' View

	UAE		**Egypt***		**Turkey**		**KSA***	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes	88%	44	78%	39	68%	34	98%	49
No	12%	6	20%	10	32%	16	----	----

Note that one Egyptian and one Saudi doctor did not answer this question. Therefore calculations pertaining to Egypt and Saudi Arabia were done over 98% instead of 100% due to missing data.

88% of the doctors from the UAE said that they thought e-commerce is a need for healthcare. Only 6 doctors among 50, stated that it is not a need. In the Egyptian sample, 78% of the doctors who have attended the survey pointed out that e-commerce is a need for healthcare and 20% claimed the opposite. 68 % of the doctors in the Turkish sample stated that e-commerce is a need for healthcare while 32% of the doctors thought that it is not. The results for the Saudi Arabia sample is

considerably different from the other countries. All of the doctors who have responded to this question (98%) pointed out that e-commerce is a necessity for healthcare.

The open ended question, why doctors think that e-commerce is a need for healthcare, brings valuable contributions to the study. Hence, some respondents from the UAE mentioned that E-commerce in healthcare will make the system faster and easier for hospitals and doctors. Additionally as there will more choices to compare from different suppliers, e-commerce would make the business more cost effective.

Some respondent doctors from the UAE commented that if there were to be a secure healthcare e-commerce platform that would help the time and efficiency of business.

Another contribution from the UAE customer insights, emphasized the essence of more coverage of territories and easy access to the needs. Finally, some UAE customers commented on accessability, time and efficiency increase for hospitals and doctors with wider spread paperless interactions that would impact the cost savings.

The Egyptian customers commented that healthcare e-commerce would work perfectly if safe infrastructure and secure payment is built including the internet setting up regulations for healthcare transactions. The Egyptian customers also referred that a safe, regulated healthcare e-commerce would improve the access, efficiency, time and choice for customers providing a platform to buy better systems to more competitive prices based on their needs.

Turkish customers highlighted easy access and possibility to check all choices from different vendors giving the opportunity to follow up and check the latest technologies. They also mentioned that healthcare e-commerce will be easy and give fast access for healthcare procurement departments and doctors, especially in rural and regional territories. Some Turkish customers also referred the time, efficiency and fastness of paperless technology and transaction provided by healthcare e-commerce as the UAE customers did. They also mentioned that having different vendors and suppliers will further improve the knowledge of hospitals and

patients, giving them the opportunity to compare all products at one site easily with no agencies or distributors in between the customers and the producer.

Finally, Saudi users had similar comments strengthening the expected positive outcomes of healthcare e-commerce with respect to accessability and less time requirement to provide healthcare needs. Some customers explained that healthcare e-commerce would bring choices for doctors and healthcare professionals in general to follow technology.

The Saudi users also pointed out that healthcare e-commerce would bring easy access for more markets, more hospitals and patients, avoiding the third party vendors in most cases which would impact the final prices positively.

In order to cross check and amplify the insights for a need in healthcare e-commerce use of the country's views and feedbacks of Healthcare IT Coordinators and Ministry of Health executives are plotted separately on the below table.

Table 4.4.21 Evaluation of a Need for Healthcare E-commerce Use; Healthcare IT Professionals' View

	UAE		**Egypt**		**Turkey**		**KSA**	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes	80%	8	93,3%	14	73,3%	11	81,8%	9
No	20%	2	6,7%	1	26,7%	4	18,2%	2

As can be noticed from the above statistical outputs, in all countries the percentage of respondents commenting positively on the need of healthcare e-commerce is much higher than the segment who do not believe the need of healthcare e-commerce at this point. Turkey is remarkable among the four selected markets with a relatively high opposing group who mention that they do not perceive healthcare e-commerce as a need. When we analyze the core reasons behind those comments and further discuss with Ministry of Health executives and respondent selected doctors, the main concerns are patient data privacy and the lack of proper regulation for healthcare commercial transactions.

The UAE healthcare authorities responding this question have highly referred to the action requirements with respect to security of healthcare e-commerce practices as

well as the clinical habits, patient and doctor cultural adaptations, and trainings to use the internet properly and compliantly for healthcare commercial transactions.

There has been a consensus among all respondents in that group who actually have been actively participating in their countries to contribute this development that if regulation will provide security for data protection and define the boundaries of those transactions properly then it will significantly grow and improve.

4.5 Healthcare Professionals' Foresights for Big Data in Healthcare

According to healthcare professionals 'Big Data in Healthcare' refers to all patient related digital health data, mainly focusing on the personal health records and further to electronic health records. In all four countries evaluated within the scope of this study, the healhcare IT professionals have replied that there is an increasing trend of big data in healthcare within the last five years.

Based on the results of user interviews, there is also a big consensus among users for the significance of electronic health records (EHR) as well as the essence of developing a National Health System (NHS). Within the implementation of big data patient privacy is raised as a number one concern among healthcare professionals as highlighted by many users during the interviews.

This concern is also reflected in the results of statistical analysis as presented in 4.3.1, impacting the development of e-health in that country. The 'Healthcare IT Professionals ' have further qualified the reasons for this increasing trend of big data in healthcare. This is presented in the table 4.5.2 below.

Table 4.5.1 Trends in Big Data in Healthcare; Insights of Healthcare IT Professionals

	UAE		**Egypt**		**Turkey**		**Saudi**	
	%	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**	**Frequency**
Increasing	90%	9	100%	15	100%	15	100%	11
Decreasing compared to last 5 years	----	----	----	----	----	----	----	----

Table 4.5.2 Reasons of Increasing Trend in Use of Big Data in Healthcare; Insights of Healthcare IT Professionals

	UAE	EGYPT	TURKEY	KSA
Increasing Customer Expectations		5 (20%)	4 (26,7%)	3 (36,4%)
Overcome governmental regulations	4 (30%)	4 (20%)	3 (13,3%)	
Efficiency gain	1 (50%)	2 (33,3%)	1 (40%)	1 (72,7%)
Gain insight for preventive care	3 (50%)			2 (27,3%)
Operational development and workforce efficiency	5 (30%)	3 (26,7%)		4 (36,4%)
Environmental security and productivity				
Improve proficiency by better utilization	2 (50%)	1 (60%)	2 (33,3%)	5 (18,2%)
Providing new business opportunities by additional income resources				
Provide competitive advantage by various analytical analysis			5 (13,3%)	
Prestige and image				
Understand customer needs/expectations and trends				

Respondents were asked to state the reasons of the big data trend in their organisations. 50% of the respondents from the UAE stated that the most important reason is efficiency gain, followed by improving proficiency by better utilization (stated by 50% of the respondents), gain insight wrt preventive care (stated by 50% of the respondents), overcome governmental regulations (stated by 30% of the respondents), and operational development and workforce efficiency (stated by 30% of the respondents) respectively.

60% of the Egyptian respondents stated that the most important reason of the big data trend is improving proficiency by better utilization.

This is followed by efficiency gain (stated by 33% of the respondents), operational development and workforce efficiency (stated by 27% of the respondents), overcoming governmental regulations (stated by 20% of the respondents) and increasing customer expectations (stated by 20% of the respondents) respectively.

50% of the Turkish respondents stated that the most important reason of the big data trend is efficiency gain followed by improving proficiency by better utilization (stated by 33% of the respondents), overcoming governmental regulations (stated by 13% of the respondents) increasing customer expectations (stated by 27% of the respondents) and provide competitive advantage by various analytical analysis (stated by 13% of the respondents) respectively.

Finally, 73% of the Saudi respondents stated that the most important reason is efficiency gain followed by gain insight wrt preventive care (stated by 27% of the respondents), increasing customer expectations (stated by 36% of the respondents), operational development and workforce efficiency (stated by 36% of the respondents) and improving proficiency by better utilization (stated by 18% of the respondents) respectively. The healthcare IT professionals have responded to the question, if e-health services were available would it be extensively and efficiently as follows:

Table 4.5.3 Expected Use of E-health In the Future

	UAE		**Egypt**		**Turkey***		**KSA**	
	Percentage	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**
Yes	50%	5	86,7%	13	73,3%	11	100%	11
No	50%	5	13,3%	2	13,3%	2	---	---

Two of the respondents in Turkey did not answer this question. Therefore, the calculation of percentages were done over 86,6% instead of 100%. 50% of the respondents in the UAE stated that their e-health system would be used efficiently in their organizations.In Egypt 86,7% and in Turkey 73,3% of the respondents said that e-health services would be extensively used if they had e- health practices in their hospitals. Saudi respondents (100%) stated that e-health practices would be used extensively if e-health infrastructure is properly implemented in the country.

4.6 Limitations of the Study and Recommendations for Future Research

First, and foremost, this study is based on the 'user' perspectives and insights to understand the approach to e-health and healthcare e-commerce challenges, as well

as related possible initiatives with respect to improving the utilization and implementation in the selected markets.

Remarkably, within the scope of this study, a judgemental sample has been used. In reality e-health and related healthcare e-commerce facilities have many different stakeholders and contributors.

Doctors and healthcare IT professionals as well as the other healthcare professionals such as hospital CEOs, CxOs or hospital coordinators and ministry of health executives are very significant in decision mechanisms and have been targeted in sampling in this research study.

On the other hand they are still only a representative part of the big picture. Other healthcare professionals such as nurses, biotechnicians and hospital department managers are not a part of the sample in this study. One of the biggest stakeholders are definitely patients who are expected to have more initiatives over their own health roadmap and decisions in the future. This study does not cover the insights from the patients which would bring a different dimension and fresh perspective to the study.

Additionally industry providers such as multinational and local pharmaceutical and diagnostic device companies also influence and have power on the ecosystem for e-health and healthcare e-commerce facilities. Although they have much influence, they are not included in the scope of the study and the related sample. Therefore even if a considerable number of customers have been selected based on a pre-determined criteria to provide a meaningful sample for the purpose of this study, the sample size is still a limitation. This study could have provided more insight with a much bigger sample including the patients and other executive insights from some leading global and local healthcare providers. Data collection has been the most crucial part of this research. Even if the questionnaires are conducted and completed by one to one visits and face to face interviews, questions still remain causing some data to be missing for the final statistical analysis. Additionally in some ranking questions the questionnaires allowed the respondent to select more than one choice in their rankings, such as ranking two or more choices equally.Further analysis of the Borda Count Method was needed for precision and better interpretation of results.

Referring to the research model, it is obvious that e-health and related healthcare e-commerce capabilities in a country is complex ecosystem of its own depending on the many different parameters that should be built and improved for a proper level of integration and use.

This study has taken some of those crucial criteria into account that would be considered critical to impact the improvement of e-health in that country, such as the infrastructure for information and communication technologies, regulatory standards and policies, trust and clinical, cultural adaptation of customers, supply chain management and financing requirements. Those parameters are structured with a model within the scope of this study, and the related hypotheses are tested and verified to be significantly contributing.

On the other hand, there are many other parameters and criteria that would complete the entire picture for proper e-health implementation and integration in a country. The dynamics of all related stakeholders, governmental changes in strategies, the approach of industry providers and impact of global trends are just some of those parameters that might have been further included in the model. As it has been discussed in the literature review, there are many different studies discussing the pros and cons for e-health and healthcare e-commerce implementation and utilization globally. It would also be concluded from the outcomes and results of this study that there is a strong consensus among the sample respondents to qualify the positive impacts of e-health and healthcare e-commerce for improving the efficiency, access and time, as well as the positive economical benefits.

On the other hand, it should be noted that these conclusions still need to be tested with respect to their degree of improvement and on the economical outcomes. There is no indepth and detailed large scale research study done for economic evaluation of e-health and healthcare e-commerce, neither in those selected markets nor globally. That is unquestionably a need as well as an area of improvement for future research and researchers. Each parameter that has been tested as a variable impacting e-health and related healthcare e-commerce practices in that study, such as clinical cultural adaptation, trust or supply chain management, have their own internal dynamics and other variables affecting them when they are treated as dependent variables. Hence literature has various studies regarding understanding

each and every of those parameters. However the literature is unfortunately limited and more literature is available for Europe and USA rather than developing markets. More in-depth country specific studies build around those impacts would also help other researchers. Including patients in the sampling and actively doing this as a comparative study among e-health developed and e-health developing countries can bring new aspects and provide roadmaps to researchers, as well as the healthcare professionals and governmental executives working on processes for implementation and improvement.

Another area of recommendation for future studies would be for healthcare e-commerce developments. Having studies to check and compare already exisiting initiatives for healthcare e-commerce from pharmaceutical and healthcare device companies, a comparative study for approaches and outcomes and challenges in different countries , the financial outcomes for the industry as well as the users would bring valuable additions to the development of healthcare e-commerce market and enlighten other industry providers to participate and encourage the market towards more utilization of healthcare e-commerce.

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APPENDIX A: QUESTIONNAIRE I[1]

E-HEALTH USER INSIGHT SURVEY (FOR CLINICIANS)

NAME:

TITLE:

INSTITUTION / HOSPITAL :/ CLINIC:

1. Do you trust online trade in healthcare business ?

    - Yes
    - No
    - Sometimes
    - Qualify if your answer is yes or sometimes

2. Do you have e-health practices (such as RIS, PACS and use of EHR) in your hospital?

    - Yes
    - Partially
    - No
    - If partially please qualify- if any other comment please qualify

If you answered yes and/or partially please answer question 3;

3. Please state how effectively e-health practices are performed in your hospital ?

Not effectively at all	Not effectively	At average	Effectively	Very effectively
1	2	3	4	5

[1] Request permission of the author to reuse Questionnaire I.

4. In your opinion what are the major drivers of a properly running e-health system ?

Major Drivers	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
ICT infrastructure Readiness					
Clinical Cultural Adaptation					
Governmental Regulations					
Financing					
Supply Chain Management					
Trust					

5. According to you what is the biggest positive impact and outcome of e-health implementation in your country? please rank from 1 to 8; 1 being the most important in your opinion.

- Economical ( )
- Time ( )
- Efficiency ( )
- Accurracy ( )
- Doctor to Doctor (D2D) communication ( )
- Patient to Doctor (P2D) communication ( )
- Improve patient journey efficiency ( )
- Improve patient empowerment ( )
- Other, please spesify ( )

6. Do you use healthcare e-commerce practices in medicine? (Pharmaceuticals)

- Yes
- No- If no why? (trust, regulation, IT Infrastructure, lack of use habit, other to spesify)
- Partially
- If partially please qualify

7. Do you use e-commerce practices for diagnostic devices?

- Yes
- No
- Partially
- If partially please qualify

8. Have you made any healthcare supply purchases online? (consumables, reusables, portable devices)

- Yes
- No
- If yes please qualify

What could a 'Healthcare Pharma/Diagnostic Device' website offer to stimulate you to purchase on the Internet rather than in a traditional purchase through the supplier ? Please qualify. (open discussion and comment question)

9. Please quality the top five requirements for you when you buy a diagnostic system; rank your answer from 1 to 5. 1 is the most important.

A. Doctor to doctor advice

B. technical information

C. Latest technology

D. Detailed Website

E. Ease of use

F. Product presentation

G. Warranty

H. Application

İ. Aftersales service

J. Price

K. Choice

L. Quality

M. Payment Facility

N. Partnership / Collaboration

O. Financing

P. Security of healthcare e-commerce site

10. According to you what are the most important criterion if you buy healthcare products online/ via e-commerce? Please rank your answer from 1 to 5. 1 is the most important and 5 is the less important.

- Reputation of the supplier
- E-commerce site; ease of use and facilities
- Delivery (Supply chain management)
- Payment security
- Choice of recontact with the supplier
- Price
- Quality
- Application option
- Financing/ Payment facilities; leasing, credit options

- Others, please spesify

11. Do you think e-commerce is a need for healthcare ?
    - Yes
    - No
    - If yes why? please qualify
    - If no why? please qualify

APPENDIX B: QUESTIONNAIRE II[2]

E-HEALTH USER INSIGHT SURVEY (Healthcare IT Professionals)

NAME:

TITLE:

INSTITUTION / HOSPITAL /MINISTRY

1. Do you have any e-health practices (EHR, initiatives for NHR, e-commerce initiatives in your hospital /* in the country ?
   - Yes
   - No
   - partially

*Note that the 'Ministry of Health Executives' answer this question from the whole country perspective.

If you answered yes and /or partially please answer question 2

2. Please state how effectively e-health practices are performed in the country ?

Not effectively at all	Not effectively	At average	Effectively	Very effectively
1	2	3	4	5

3. Which parameters do you see as major challenge(s) for proper e-health development and utilization in medical sector in your country? Please rank from 1 to 7; 1 being the most important.
   - Information and Communication Technology (ICT) Infrastructure ( )
   - Trust on security for e-business in healthcare ( )
   - Financial solutions/ease of purchase (leasing, credit) ( )

[2] Request permission of the author to reuse questionnaire II.

- Supply chain management ( )
- Cultural readiness and engagement of healthcare professionals ( )
- Governmental regulatory policies and standards ( )
- Other, please spesify ( )

In your opinion what are the major drivers of a properly running e-health system?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
ICT Infrastructure readiness					
Clinical Cultural Adaptation					
Governmental regulations and standards					
Financing					
Supply Chain Management					
Trust					

4. Which parameters do you see as major challenge(s) for proper healthcare e-commerce utilization in medical sector in your country? Please rank from 1 to 7; 1 being the most important.
   - ICT Infrastructure ( )
   - Trust on security for e-business in healthcare ( )
   - Financing financial solutions/ease of purchase (leasing, credit) ( )
   - Supply chain management ( )
   - Cultural readiness and engagement of healthcare professionals ( )
   - Governmental regulatory policies and standards ( )
   - Other, please spesify ( )

Please mention further your view for the following (possible) e-health implementation and utilization challenges (where e-health is referred as (‘all e-business in healthcare’);

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
ICT Infrastructure Readiness					
Clinical Cultural Adaptation					
Governmental regulations and standards					
Financing					
Supply Chain Management					
Trust Online Business					

5. According to you what is the biggest positive impact of e-health implementation in your country? Please rank from 1 to 8; 1 being the most important in your opinion.
   - Economical ( )
   - Time ( )
   - Efficiency ( )
   - Accurracy ( )
   - D2D (Doctor to Doctor) communication ( )
   - P2D (Patient to Doctor) communication ( )
   - Improve patient journey efficiency ( )
   - Improve patient empowerment ( )
   - Other, please spesify ( )

6. How do you qualify the big data trend in your country with respect to trends in the last five years ?
   - Increasing
   - Decreasing compared to last 5 years
   - Same

7. According to you what is the reason of this trend ?
   - Increasing customer (patient) expectations
   - Overcome governmental regulations

- Efficiency gain
- Gain insight with respect to preventive care
- Operational development and workforce efficiency
- Environmental security and productivity
- Improve proficiency by better utilizatıon of (HR, Personnel, equipment, consumables).
- Providing new business opportunities by additional income resources
- Provide competitive advantage by various analytical analysis
- Prestige and image
- Understand the customer needs / expectations and trends
- Other _____

8. If you have e-health system practices in your hospital, do you think it is used extensively and efficiently ?
   - Yes
   - No
9. Do you measure e-health practices in your hospital / in general ?
   - Yes
   - No
   - Not Applicable
10. How frequently do you measure e-health services use in your hospital ?
   - everyday
   - every week
   - Every month
   - Other, spesify
11. Which service is most frequently used ?
   - Information, main page – doctors, services
   - Pricing
   - Insurance
   - Online services
   - Medical consultancy
   - Other, please
   - Not Applicable

12. Do you make any online purchase from healthcare suppliers ?
    - Yes
    - No
    - Sometimes
13. Which healthcare products do you buy online ?
    - Consumables
    - Equipment
    - Not applicable
    - Others, please spesify
14. Is there any drawback with healthcare e-commerce web sites ?
    - Yes
    - No
    - If yes, please spesify
15. Are there any regulatory barriers for the hospital website ?
    - Yes
    - No
16. Please quality the top 5 requirements for you when you buy a diagnostic system; rank your answer from 1 to 5 : 1 is the most important .
    - Doctor to doctor advice
    - technical information
    - Latest technology
    - Detailed website
    - Ease of use
    - Product presentation
    - Warranty
    - Application
    - Aftersales service
    - Price
    - Choice
    - Quality
    - Payment Facility
    - Partnership/Collaboration

- Financing
- Security of healthcare e-commerce site

17. According to you what are the most important criterion if you buy healthcare products online? (healthcare e-commerce)

Please rank your answer from 1 to 10 : 1 is the most important in your opinion.

- Reputation of the supplier
- e-commerce site ease of use and facilities
- Delivery (supply chain management)
- Payment security
- Choice of recontact with the supplier
- Price
- Quality
- Application option
- Financing; payment facilities; leasing, credit options
- Others, please spesify

18. Do you think e-commerce is a need for healthcare ?

- Yes
- No
- If yes why? Please qualify
- If no why? Please qualify

APPENDIX C: UAE EVALUATIONS/BORDA COUNT METHOD

Question 8 of the Questionnaires;

There are 5 criteria to be listed on this question. The first criterion gets 5 points, second 4 points, third 3 points, fourth 2 points, fifth 1 points.

Doctor to Doctor Advice

Criterion	Votes	Values	Points
First	8	5	40
Second	7	4	28
Third	2	3	6
Forth	---	2	
Fifth	3	1	3
Total	20		**77**

Technical Information

Criterion	Votes	Values	Points
First	1	5	5
Second	3	4	12
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	4		**17**

Latest Technology

Criterion	Votes	Values	Points
First	38	5	190
Second	5	4	20
Third	4	3	12
Forth	---	2	
Fifth	---	1	
Total	47		**222**

Detailed Website

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Ease of Use

Criterion	Votes	Values	Points
First	3	5	15
Second	3	4	12
Third	2	3	6
Forth	3	2	6
Fifth	---	1	
Total	11		**39**

Product Presentation

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Warranty

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	1	2	2
Fifth	1	1	1
Total	3		**6**

Application

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	---	2	
Fifth	1	1	1
Total	2		**4**

Aftersales Service

Criterion	Votes	Values	Points
First	---	5	
Second	2	4	8
Third	1	3	3
Forth	24	2	48
Fifth	16	1	16
Total	43		**75**

Price

Criterion	Votes	Values	Points
First	1	5	5
Second	4	4	16
Third	28	3	84
Forth	13	2	26
Fifth	2	1	2
Total	48		**133**

Choice

Criterion	Votes	Values	Points
First	---	5	
Second	2	4	8
Third	1	3	3
Forth	2	2	4
Fifth	---	1	
Total	5		**15**

Quality

Criterion	Votes	Values	Points
First	4	5	20
Second	26	4	104
Third	12	3	36
Forth	5	2	10
Fifth	2	1	2
Total	49		**172**

Payment Facility

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	2	2	4
Fifth	15	1	15
Total	17		**19**

Partnership/Collaboration

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	10	1	10
Total	10		**10**

Financing

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	1	1	1
Total	1		**5**

Security

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Total Points of the Criteria for UAE

Criterion	**Points**
Doctor to doctor advice	77
Technical information	17
Latest technology	222
Detailed website	0
Ease of use	39
Product presentation	0
Warranty	6
Application	4
Aftersales service	75
Price	133
Choice	15
Quality	172
Payment facility	19
Partnership	10
Financing	5
Security of healthcare e-commerce site	0

APPENDIX D: EGYPT EVALUATIONS/BORDA COUNT METHOD

Question 8 of the questionnaires;

There are 5 criteria to be listed on this question. The first criterion gets 5 points, second 4 points, third 3 points, fourth 2 points, fifth 1 points.

Doctor to Doctor Advice

Criterion	Votes	Values	Points
First	6	5	30
Second	6	4	24
Third	8	3	24
Forth	2	2	4
Fifth	1	1	1
Total	23		**83**

Technical Information

Criterion	Votes	Values	Points
First	14	5	70
Second	7	4	28
Third	4	3	12
Forth	---	2	
Fifth	---	1	
Total	25		**110**

Latest Technology

Criterion	Votes	Values	Points
First	27	5	135
Second	4	4	16
Third	2	3	6
Forth	5	2	10
Fifth	3	1	3
Total	41		**170**

Detailed Website

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Ease of Use

Criterion	Votes	Values	Points
First	10	5	50
Second	10	4	40
Third	2	3	6
Forth	3	2	6
Fifth	2	1	2
Total	27		104

Product Presentation

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	---	2	
Fifth	---	1	
Total	1		**3**

Warranty

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	4	3	12
Forth	1	2	2
Fifth	8	1	8
Total	13		**22**

Application

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	4	3	12
Forth	3	2	6
Fifth	6	1	6
Total	13		**24**

Aftersales Service

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	7	3	21
Forth	18	2	36
Fifth	5	1	5
Total	30		**62**

Price

Criterion	Votes	Values	Points
First	---	5	
Second	13	4	52
Third	21	3	63
Forth	6	2	12
Fifth	1	1	1
Total	41		**128**

Choice

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Quality

Criterion	Votes	Values	Points
First	12	5	60
Second	24	4	96
Third	4	3	12
Forth	3	2	6
Fifth	---	1	
Total	43		**174**

Payment Facility

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	4	3	12
Forth	7	2	14
Fifth	11	1	11
Total	22		**37**

Partnership/Collaboration

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	5	2	10
Fifth	14	1	14
Total	20		**27**

Financing

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	5	2	10
Fifth	---	1	
Total	6		**13**

Security

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	1	1	1
Total	1		**1**

Total Points of the Criteria for Egypt

Criterion	**Points**
Doctor to doctor advice	83
Technical information	110
Latest technology	170
Detailed website	0
Ease of use	104
Product presentation	3
Warranty	22
Application	24
Aftersales service	62
Price	128
Choice	0
Quality	174
Payment facility	37
Partnership	27
Financing	13
Security of healthcare e-commerce site	1

APPENDIX E: TURKEY EVALUATIONS/BORDA COUNT METHOD

Question-8 of the questionnaires;

There are 5 criteria to be listed on this question. The first criterion gets 5 points, second 4 points, third 3 points, fourth 2 points, fifth 1 points.

Doctor to Doctor Advice

Criterion	Votes	Values	Points
First	18	5	90
Second	9	4	36
Third	7	3	21
Forth	6	2	12
Fifth	2	1	2
Total	42		**161**

Technical Information

Criterion	Votes	Values	Points
First	13	5	65
Second	7	4	28
Third	7	3	21
Forth	1	2	2
Fifth	---	1	
Total	28		**116**

Latest Technology

Criterion	Votes	Values	Points
First	19	5	95
Second	12	4	48
Third	3	3	9
Forth	---	2	
Fifth	---	1	
Total	34		**152**

Detailed Website

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	5	3	15
Forth	3	2	6
Fifth	2	1	2
Total	10		**23**

Ease of Use

Criterion	Votes	Values	Points
First	8	5	40
Second	6	4	24
Third	5	3	15
Forth	7	2	14
Fifth	1	1	1
Total	27		**94**

Product Presentation

Criterion	Votes	Values	Points
First	1	5	5
Second	---	4	
Third	5	3	15
Forth	4	2	8
Fifth	3	1	3
Total	13		**31**

Warranty

Criterion	Votes	Values	Points
First	1	5	5
Second	3	4	12
Third	5	3	15
Forth	2	2	4
Fifth	3	1	3
Total	14		**39**

Application

Criterion	Votes	Values	Points
First	2	5	10
Second	6	4	24
Third	3	3	9
Forth	4	2	8
Fifth	2	1	2
Total	17		**53**

Aftersales Service

Criterion	Votes	Values	Points
First	1	5	5
Second	7	4	28
Third	5	3	15
Forth	7	2	14
Fifth	8	1	8
Total	28		**70**

Price

Criterion	Votes	Values	Points
First	8	5	40
Second	5	4	20
Third	12	3	36
Forth	8	2	16
Fifth	5	1	5
Total	38		**117**

Choice

Criterion	Votes	Values	Points
First	2	5	10
Second	4	4	16
Third	4	3	12
Forth	1	2	2
Fifth	---	1	
Total	11		**40**

Quality

Criterion	Votes	Values	Points
First	20	5	100
Second	13	4	52
Third	6	3	18
Forth	1	2	2
Fifth	---	1	
Total	40		**172**

Payment Facility

Criterion	Votes	Values	Points
First	1	5	5
Second	1	4	4
Third	8	3	24
Forth	2	2	4
Fifth	2	1	2
Total	14		**39**

Partnership/Collaboration

Criterion	Votes	Values	Points
First	3	5	15
Second	6	4	24
Third	8	3	24
Forth	6	2	12
Fifth	13	1	13
Total	36		**88**

Financing

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	2	2	4
Fifth	3	1	3
Total	6		**10**

Security

Criterion	Votes	Values	Points
First	1	5	5
Second	1	4	4
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	2		**9**

Total Points of the Criteria for Turkey

Criterion	**Points**
Doctor to doctor advice	161
Technical information	116
Latest technology	152
Detailed website	23
Ease of Use	94
Product presentation	31
Warranty	39
Application	53
Aftersales service	70
Price	117
Choice	40
Quality	172
Payment facility	39
Partnership	88
Financing	10
Security of healthcare e-commerce site	9

APPENDIX F: KINGDOM OF SAUDI ARABIA EVALUATIONS/ BORDA COUNT METHOD

Question-8 of the questionnaires;

There are 5 criteria to be listed on this question. The first criterion gets 5 points, second 4 points, third 3 points, fourth 2 points, fifth 1 points.

Doctor to Doctor Advice

Criterion	Votes	Values	Points
First	26	5	130
Second	12	4	48
Third	5	3	15
Forth	4	2	8
Fifth	---	1	
Total	47		**201**

Technical Information

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	---	2	
Fifth	---	1	
Total	1		**3**

Latest Technology

Criterion	Votes	Values	Points
First	3	5	15
Second	14	4	56
Third	17	3	51
Forth	8	2	16
Fifth	4	1	4
Total	46		**142**

Detailed Website

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	1	2	2
Fifth	---	1	
Total	1		**2**

Ease of Use

Criterion	Votes	Values	Points
First	15	5	75
Second	18	4	72
Third	7	3	21
Forth	5	2	10
Fifth	1	1	1
Total	46		**179**

Product Presentation

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Warranty

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	0		**0**

Application

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	1	2	2
Fifth	2	1	2
Total	4		**7**

Aftersales Service

Criterion	Votes	Values	Points
First	1	5	
Second	1	4	
Third	1	3	3
Forth	5	2	10
Fifth	3	1	3
Total	11		**16**

Price

Criterion	Votes	Values	Points
First	---	5	
Second	4	4	16
Third	10	3	30
Forth	14	2	28
Fifth	9	1	9
Total	37		**83**

Choice

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	2	1	2
Total	2		**2**

Quality

Criterion	Votes	Values	Points
First	20	5	100
Second	7	4	28
Third	5	3	15
Forth	5	2	10
Fifth	2	1	2
Total	39		**155**

Payment Facility

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	---	3	
Forth	---	2	
Fifth	1	1	1
Total	1		**1**

Partnership/Collaboration

Criterion	Votes	Values	Points
First	---	5	
Second	2	4	
Third	4	3	12
Forth	4	2	8
Fifth	20	1	20
Total	30		40

Financing

Criterion	Votes	Values	Points
First	---	5	
Second	---	4	
Third	1	3	3
Forth	3	2	6
Fifth	2	1	2
Total	6		11

Security

Criterion	Votes	Values	Points
First	1	5	5
Second	2	4	8
Third	---	3	
Forth	---	2	
Fifth	---	1	
Total	3		**13**

Total Points of the Criteria for the Kingdom of Saudi Arabia

Criterion	**Points**
Doctor to doctor advice	201
Technical information	3
Latest technology.	142
Detailed website	2
Ease of use	179
Product presentation	0
Warranty	0
Application	7
Aftersales service	16
Price	83
Choice	2
Quality	155
Payment facility	1
Partnership	40
Financing	11
Security of healthcare e-commerce site	13

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