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Formulation of a National e-Health Strategy Development Framework for Pakistan

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by

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Abstract

Health systems across developing and developed countries face constant and difficult challenges in coping with an ever increasing demand for health care. At the same time, the world has witnessed an ever increasing influence of (ICT) in health care delivery. This has become known as ‘e-health’ and is broadly composed of four domains such as telehealth, health informatics, e-Learning and e-Commerce. e-Health in spite of its usefulness in isolated settings across the globe, still lacks sustainable integration into existing health systems for lack of ‘thoughtful strategy’. This thesis establishes an e-Health Strategy Development Framework (e-HSDF). The methodology includes literature review to identify tools for conceptual framework along with synthesis of evidence to formulate the complete the e-HSDF. Pakistan was used as an example for hypothetical application of the e-HSDF. The completion of the framework contributes to the field of e-health implementation by providing a structured, systematic and evidence-based tool.

Acknowledgements

This journey would not be completed without the support of many individuals. I would like to thank my research supervisor Dr Richard E Scott who facilitated and helped me in conducting this research. Dr Scott helped me throughout this journey of learning by his intellectual wisdom and support. He guided me relentlessly throughout my student career here at the University of Calgary not only as a research supervisor but also as a faculty member. Dr William Chad Saunders for his academic input in organizing my thesis and in his strategy acumen. Many thanks to Dr Shariq Khoja for providing me thoughtful insight from both the global and local perspective in e-health and in health systems. Dr Haroon Khan who gave great support from Pakistan in terms of gathering country specific evidence. Finally, I would like to recognize the dedicated faculty for sharing their knowledge and to the staff of Community Health Sciences Department for their continuous support throughout my student life.

Dedication

To my beloved wife, Beena and my little ones Adyan and Aisha, for their love, support and affection. Without their unconditional support, I would not be able to accomplish this learning quest on my own.

List of Symbols, Abbreviations and Nomenclature

CME:	Continuing Medical Education
CPD:	Continuous Professional Development
GDP:	Gross Domestic Product
GNP:	Gross Natural Product
e-HAP:	e-Health Association of Pakistan
e-Health:	Electronic health
EHR:	Electronic Health Record
EPR:	Electronic Patient Record
EC:	European Commission
EU:	European Union
FATA:	Federally Administered Tribal Areas (FATA)
HMIS:	Health Management Information Systems
HIV/AIDS:	Human immunodeficiency virus infection / acquired immunodeficiency syndrome
ICT:	Information and Communications Technology/ies
IDP:	Internally Displaced Person
IT:	Information Technology
ITU:	International Telecommunications Union
PAHO:	Pan American Health Organisation
PHP:	Provincial Health Plan
PHR:	Personal Health Record
MMR:	Maternal Mortality Rate
MOH:	Ministry of Health
NGO:	Non Governmental Organisation
NHS:	National Health Service
WHO:	World Health Organization

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Chapter 1: Introduction

1.1 Introduction to the Research Problem

Health systems across developing and developed countries face constant and difficult challenges in coping with an ever increasing demand for health care (1). Although developed countries have largely overcome the communicable disease burden through effective immunization and public health strategies, they remain challenged by aging populations, an increasing burden of non-communicable disease, shortages of human health resources, and geographically remote access for service provision (2, 3). In addition to the above challenges, developing countries also face communicable disease burden, maternal and child health issues, resource constraints, and a lack of evidence to formulate policies (4, 5).

In the past several decades, the world has witnessed an ever increasing influence of Information and Communication Technologies (ICTs) as a catalyst for health care delivery (6). This has become known as 'e-health'. For example, health care systems of many developed countries use ICTs to facilitate delivery of health care services to patients (7). In contrast, the literature shows developing countries still use telemedicine (one component of e-health) in isolated settings, and do not use the full potential of e-health due to a lack of planning, capacity, and resources (8, 9). e-Health is now a universally accepted domain in health care yet there is a profound lack of insight in terms of processes to develop e-health strategy documents that facilitate progress by governments, NGO's, regions or health care organizations.

1.2 What is e-Health ?

According to the World Health Organization, e-health is the use of ICT within the health sector. It encompasses the use of ICT via telehealth for the treatment and diagnosis of disease, health informatics to support patient data and information and e-learning for health education (10). Iakovidis viewed e-health as a modality at the intersection of medical informatics, public health and business, referring to health services and information delivered through the Internet and related technologies (11). Note however that the Internet is not required for all e-health applications, as evidenced by the rise of m-health (‘mobile health’ using handheld devices) that utilises cellular networks.

Similarly, Health Canada (12) considers e-health applications to be broad, stretching from purely administrative tools, to health care delivery tools. Examples, associated with different care settings, include:

- Hospital care setting: electronic patient administration systems; laboratory information systems (LIS); radiology information systems (RIS); electronic messaging systems; and, telehealth (telemedicine) applications such as teleconsultations, telepathology, teledermatology, televisitation.
- Home care setting (including the residential care setting): teleconsultations; bio-monitoring (remote vital signs monitoring, fall detection); home dialysis monitoring; and e-learning for education of patients or family members.
- Primary care setting: Use of computer systems by general practitioners and pharmacists for patient management, medical records and electronic prescribing;

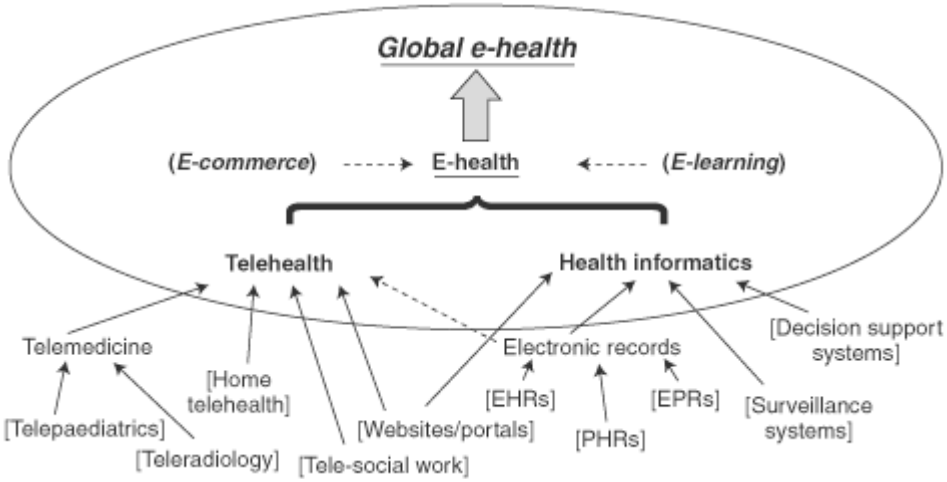
decision support systems to aid diagnosis or adhere to clinical practice guidelines; skill and knowledge development through CPD/CME.

- Remote communities setting: access to specialists through teleconsultations, avoidance of out-of-community travel.

Scott contributed in 2009 with the following figure (Figure 1) which depicts e-health applications in a diagrammatic way (13). This figure illustrates the two major components of e-health are Telehealth and Health Informatics with two related and contributory components (e-Learning, and e-Commerce). Each of the major components is comprised of different applications. For example, telehealth is comprised of telemedicine, home telehealth and health portals. Similarly, health informatics covers a wide range of applications including electronic records, patient data transfer mechanisms, and decision support systems.

Benefits accrue through these applications of e-health, including greater clinical efficiency, minimizing cost and time related to travel, and minimizing the impact of the lack of human health resources in rural and remote areas (14, 15). Open source tools such as i-Path are being used in many countries to transfer images and pictures for diagnosis and treatment purposes (16). Very recently, telemedicine showed its effectiveness in diagnosing tuberculosis in developing countries (17). Telemedicine via teleradiology also helped in improving the patient diagnosis and management between tertiary and primary care units in developing countries (18). With the help of e-health technology it is now

Figure 1: The relationship of major components of e-health (from Ref. 13)



possible for rural and remote communities to have access to a higher quality of health care similar to that available in urban areas (19).

1.3 What is the Importance of e-Health Strategy ?

The world is witnessing an ever increasing use of e-health in health care systems across the globe (20). This development poses a risk of duplication and waste of resources if e-health opportunities are not properly identified and structured in the early stages of e-health implementation for any given country (21). Many countries, institutions and regions have already established sufficient evidence in terms of readiness for e-health (22). None the less, e-health strategy development helps in aligning the correct health needs with appropriate technological solutions in health systems such as service planning, innovation, and clinical and operational decision at the country, region or facility level (23).

Only very recently has discussion begun across the globe with respect to creating e-health strategy. In the following section, a few initiatives are described.

1.3.1 World Health Organization – e-Health Initiative

Formulating an e-health strategy has been among the top priorities of the World Health Organization (WHO) for almost a decade. In 2005, WHO acknowledged the need of ICT in its Millennium Development Goals (MDG) (24). Also in 2005 the WHO, via its e-Health Resolution, first promoted the need for formulating national e-health strategy documents by member countries to address their health care issues, especially in resource poor settings (25). This need was reiterated in 2006 when the WHO stated "the most favorable approach to the implementation of e-health at the national level is to have a framework of strategic plans and policies which lay the foundations for development. It also urged its member states to move forward and help in developing the infrastructure for e-health activities as deemed necessary to promote equitable, affordable, and universal access to health care (26). The need for closer collaboration with private and not for profit organizations working in e-health was stressed, in order to avoid duplication, to reach rural and- remote communities and vulnerable groups.

1.3.2 Bellagio e-Health Conference

With the support of the RockeFeller Foundation, in the year 2008, e-health emerged as a major theme for renewal of health systems in developing countries. The Foundation joined with partners to organise an invitation-only series of 8 workshops that focused on using e-health in innovative ways to improve public health and health care, even in the

most challenging of settings and conditions. Academics, ICT experts, health professionals, researchers, media, donors, and policy analysts from around the world gathered to examine and debate e-health barriers, enablers, and sustainability in several areas:

- The path to inter-operability
- Public health informatics and national health information systems
- Access to health information and knowledge-sharing
- e-Health capacity building
- Electronic health records
- Mobile phones and telemedicine
- National e-health policies

This ‘Making the e-Health Connection’ initiative identified a significant series of themes and made many recommendations. These included: moving from silos to systems; encouraging donors and stakeholders to reduce donor fragmentation, harmonize donor requirements, and develop an e-health “business case” to encourage investment. Also encouraged was development of Centers of Excellence, Collaborative Action Networks, Internet-based Portals (for knowledge and information-sharing), Taskforces, e-Health Associations in each country, e-Health promotion networks, strategic alliances, and enhanced university programs and partnerships. Notable and proximal impacts of Making the e-Health Connection were establishing the m-Health Alliance, initiating the e-Health Ambassadors initiative, and creation of the e-Health Association of Pakistan (based on

the goal to foster the establishment and support of national e-Health Councils in countries) (27).

1.3.3 The Pan American Health Organization Resolution

In late 2011, The Pan American Health Organization (PAHO) in its 51st Directing Council stressed the need for member countries to develop their own 'e-health strategies'. The primary driver was to improve access and quality of health services through the use of ICTs (28).

PAHO has identified 5 key areas that need to be considered while formulating their country specific 'e-health' strategy. These are as follows:

1) Electronic medical records
2) Telehealth (health care delivery using ICT's)
3) m-Health (use of mobile devices such as mobile phones or pads)
4) e-Learning (increased access to distance education) and continuing education (updated information for health professionals and patients)
5) Interoperability and standardization (comparability between different technologies and common health standards)

The broader plan of action for the e-health strategy included the following goals:

- Support and promote the development, implementation, and evaluation of e-health public policies in the countries of the Americas.
- Improve organizational and technological infrastructure to facilitate the incorporation of e-health policies.

- Identify a legal framework that supports the use of health ICTs and facilitates electronic sharing of clinical information at the national and regional levels. This legal framework will promote the validity of telemedicine activities and ensure the protection of personal data.
- Promote the use of epidemiologic surveillance services through the use of ICT.
- Promote and facilitate cooperation among countries in developing a digital health agenda for the region.
- Foster intersectoral cooperation within and between countries and establish electronic mechanisms for sharing best practices, regional resources, and lessons learned.
- Promote training in health ICT in universities and among health professionals.
- Provide reliable, quality information on health education and disease prevention to health professionals and the population at large.

1.3.4 The European Union – e-Health Action Plan

The European Commission (EC) is an autonomous body that has the 'right of initiative' to propose law for adoption by the European Parliament and the Council. e-Health remains a focus of the EC, and has been so for almost two decades. Initially the program was built around isolated domains like electronic health-care records, regional and national health networks, telemedicine in homecare and e-learning. There are 27 member states of the European Union in addition to four other countries Iceland, Norway, Switzerland and Turkey which also initiated the process (29).

One major achievement occurred in 2004 when an action plan for a European e-Health Area (eH-AP) was adopted. This adoption committed the European Union (EU) 'to develop a national or regional roadmap for e-Health'. By 2006, most European Union Member States had published high level official policy documents on their e-Health strategy. The key areas of action were:

- Legal activities
- Evaluation
- Electronic health record
- e-Prescription
- Telehealth
- Patient ID
- Professional ID
- Operation standards

Some of the key areas discussed here in this research were Telehealth and e-Prescription. The EC defined Telehealth as "the delivery of healthcare services through the use of Information and Communication Technologies (ICT) in a situation where the provider and recipient are not at the same location". Most of the countries in the EU have expended considerable effort to establish regulatory processes, especially with respect to accreditation, liability coverage, and legal issues while conducting telehealth consults (29). The other area was e-Prescription. This was described as the process of the electronic transfer of a prescription by a healthcare provider in a primary care or community health centre setting to a pharmacy for retrieval of the drug by the patient.

Only a few European countries have implemented a fully operational national primary care e-Prescription services as of August 2012 (29).

1.4 Section summary

Despite all of the above examples of activity in recent years, a fundamental question remains: 'What e-Health solutions are required for a given scenario and situation in a given health system'? Understanding the response requires development of an e-health strategy.

Policy- and decision-makers need to mitigate the risk of failure, avoid waste and duplication of resources, and address anticipated barriers based on evidence. The challenge is that there is no available evidence-based guidance or e-health strategy tool that first performs a holistic review to account for the unique situation and circumstances of a setting (country, sub-national region, or facility). Hence, the purpose of this study is to first formulate a conceptual framework based upon literature evidence, then identify evidence based tools to support stages in the framework, and then to formulate a final framework that will guide e-health strategy development for a given setting.

Chapter 2: Literature review

The literature review was organized in different stages in this research to gather the necessary evidence to create the key deliverable of this study - that is the e-Health Strategy Development Framework (e-HSDF). There were four major goals of the literature searches in this research:

1) To identify published research articles, using Ovid Medliine, pertaining to e-health strategy and a conceptual framework
2) To identify existing strategy theories in e-health or in other sectors.
3) To gather evidence of country specific e-health strategy documents, using the grey literature and Ovid Medline
4) To identify existing tools that might facilitate performance of stages of the conceptual framework.

2.1 Index Literature Search – Strategy Theory and e-Health Strategy

The first literature search was intended to identify existing e-health strategy documents that inform content for the framework. The Ovid Medline (30) search engine was used to identify relevant articles. The search covered a period from 1992 to 2012. The Boolean search was organized around the specific research question specified and covered all aspects of the question in order to capture the maximum number of articles. The first Boolean search to identify articles used the key terms ‘ehealth and strategy’ and

was further enhanced by using MeSH headings like ‘strategies’ and ‘telehealth’ in the search.

The initial search found a total of 505 articles. These articles included key words in any one the following sections: abstract, title, references, subject heading, methodology, result, protocol, or conclusion. The second Boolean search was then conducted using key words such as “ehealth, telehealth and strategy” in the advance filter process (looking only in the abstract or original title of the manuscript). A total of 31 articles were retrieved after the search and was labeled as ‘List 1’. The third Boolean search was then conducted using key words such as “e-health and strategy” (note ‘e-health’, not ‘ehealth’) in the advance filter process (looking only in abstract or original title of the paper). This process identified 51 articles and was labeled as ‘List 2’.

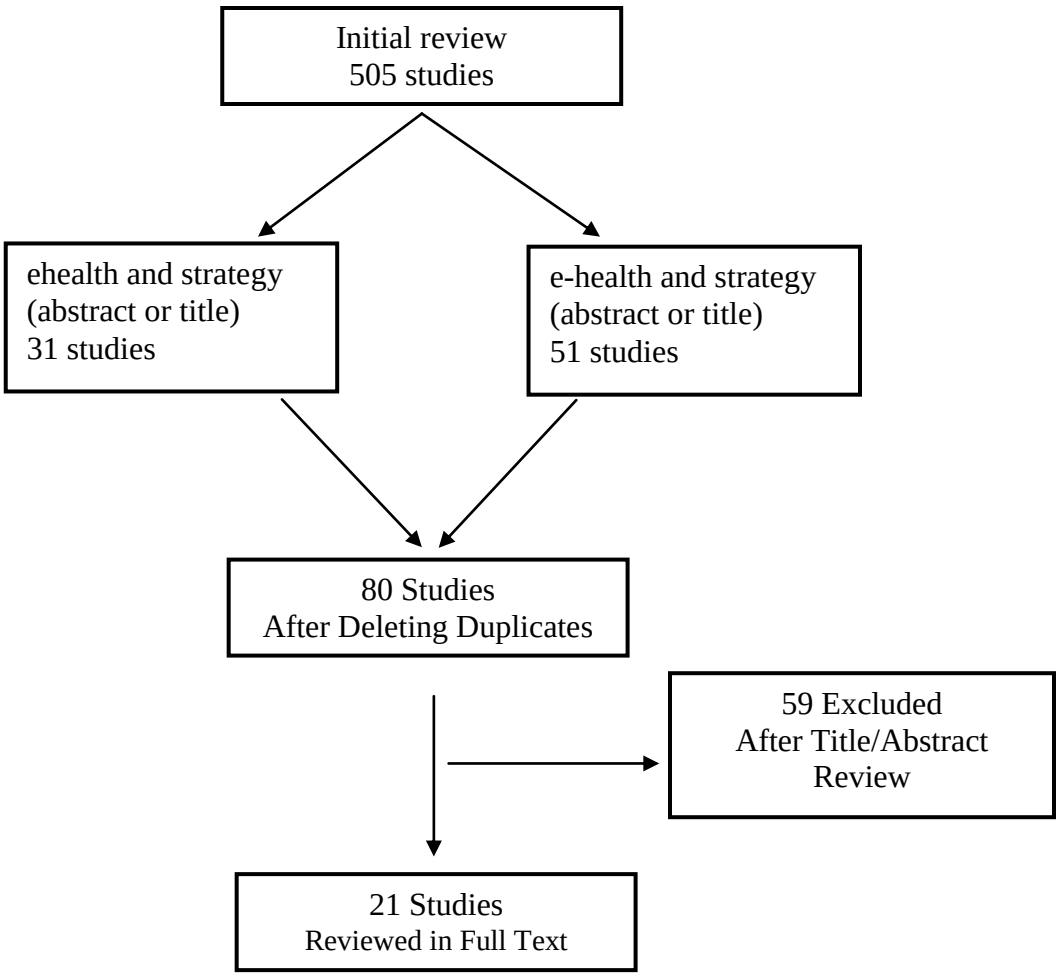
The next stage comprised of reviewing all the abstracts from both the lists against inclusion and exclusion criteria. The inclusion criteria were: the abstract mentioned national or local strategy development related to telehealth or e-health broadly, it was published in a peer reviewed journal, the year of publication was between 1992 and 2012, and regions of globe (like LMIC, middle income or developed world) were noted. The exclusion criteria were: the abstract identified a specific clinical telemedicine or e-health pilot project, or mentioned e-health strategy in passing and was not a focus of the work.

After this initial review of abstracts, 10 articles were found to be relevant to the research from List 1 and 12 articles from List 2; these were selected for full text review.

Two articles were removed because of duplication. This search strategy is elaborated in Figure 4.

In addition to searching journal publications, a web search and hand-searching helped to identify "e-health strategy" documents from the grey literature that were available at regional, country, or sub-national settings from across the globe. The Google search engine was used to search and retrieve country specific e-health strategy documents. National and provincial documents were retrieved from both the developing and developed world. Considerable additional effort was devoted to searching and reading specific documents for Pakistan (to permit the theoretical application of the e-HDSF).

Figure 2. Flow Chart of the 'index literature search' pertaining to "e-health" and "strategy" from Ovid Medline.



2.2 What is Strategy?

This section deals with the concept of strategy. Many schools of thought and models pertaining to strategy are available in the literature, stemming primarily from the business literature. Strategy can be defined in a very simplistic way as ‘a plan designed to achieve particular long term goals’ (31). Another point of view defines strategy as ‘the pattern or plan that integrates an organization’s major goals, policies, and action sequence into a cohesive whole’. A well formulated strategy for an organization helps to progress and allocate organizational resources into a unique and viable posture based on its relative internal competencies and shortcomings, anticipated changes to the environment, and likely moves by opponents (32). There are three main models for strategy development available in the literature: the five P strategy model, the deliberate and emergent model, and Boisot’s theory of strategy again taken from the business sector (no available strategy models for e-health exist).

2.2.1 Five “P’ for Strategy Theory

From the business sector, Henry Mintzberg emphasizes the emergent nature of the process of strategy formation. Mintzberg presented five different ways to describe strategy as being used by institutions and governments in different ways and meanings (32).

1) Plan : Strategy as a ‘Plan’ is a conscious course of action to move from a current state to a desired future end state

2) Pattern: Strategy as a ‘Pattern’ is a consistency of behaviour by an organization or person over a period of time.
3) Position: Strategy as a ‘Position’ signifies the location of a particular organization in context to its environment. A position can be ‘pre-selected’ or goal oriented (can be reached at the end).
4) Perspective: Strategy as a ‘Perspective’ represents strategy in a terms of ‘who you are’ based on the notion of what the organization is fundamentally about. It is more about the organization’s core set of values
5) Ploy: Strategy as a ‘Ploy’ is an action calculated to disturb an opponent or to confront a competitor or opponent.

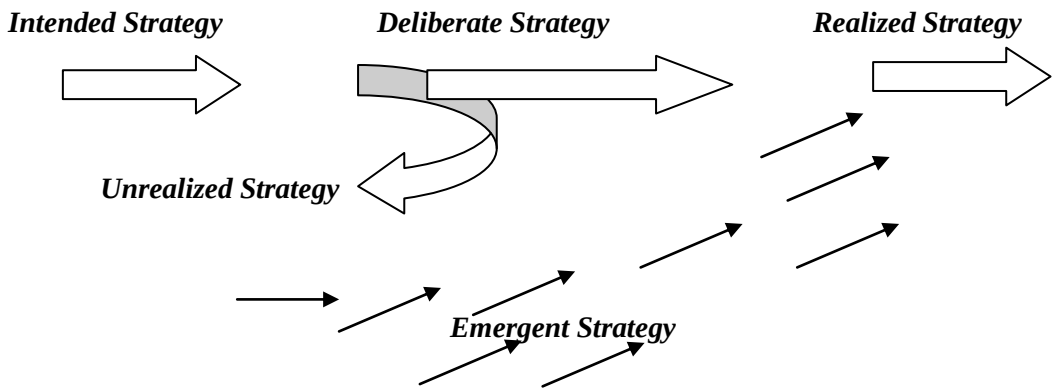
It is important to understand that these definitions were evolved from the business perspective and might not be relevant to the health care scenario; they are mentioned here to support the theoretical evidence around the strategy literature.

2.2.2 Deliberate and Emergent Strategy Theory

Mintzberg and Walters (33) presented a concept that described the strategy process as a continuum (Figure 3), with *intended* strategies on one end and *realized* strategies at the other end. They recognized that some strategy may begin as an ‘intended strategy’ but not be viable and therefore will fall by the wayside and become ‘unrealized strategy’; in contrast, successful ‘intended strategy’ would transform to become ‘deliberate strategy’. They further recognized that in a dynamic real-world setting unexpected factors could create ‘emergent strategy’, and that this emergent strategy could

combine with deliberate strategy to ultimately create 'realized strategy' – the course of action actually pursued.

Figure 3: Mintzberg and Walters concept of intended and realized strategy (from Ref 33)



2.2.3 Boisot's Theory of Strategy

Boisot in 1995 presented a concept to relate the levels and perceptions of the prevailing setting to the type of response that institutions formulate for strategies (34). Table 1 presents this concept as a matrix, with *understandability of environment* on the top row and *environmental turbulence* on a left vertical column. Within this matrix, Boisot identified four types of strategy approach namely; 1) strategic planning, 2) emergent strategy, 3) intrapreneurship, and 4) strategic intent.

Table 1: Bosiot's strategy theory depicting understandability of the environemnt and environmental turbulence

	Understandability of Environment	
Environmental Turbulence	**Low**	**High**
High	Intrapreneurship	Strategic Intent
Low	Emergent Strategy	***Strategic Planning***

In *Intrapreneurship,* a high level of turbulence with a low of level of understanding of the environment exists, so it can be viewed as a chaotic and challenged stage. In *Emergent Strategy,* the level of turbulence and understanding are both low and the strategy emerges over a period of time. *Strategic Intent* shows a high level of understanding permitting activities to be aligned with a common goal but with a high level of turbulence. *Strategic Planning* is considered optimal when a deeper understanding of the environment exists and there is a low level of environmental turbulence.

2.2.4 Applying the Selected Strategy Theories to this Research

It is accepted that health care delivery in any health care system faces constant challenges both in curative and preventive aspects. As a result of this complexity it is necessary to see a path forward, and the notion of strategy as a "plan" sits well within the context of complex health systems as it shows thoughtful movement from one point to another according to need and conditions. Further, relating Mintzberg's 5 types of

strategy to the deliberate and emergent strategy concept, it is possible to relate strategy as a ‘plan’ (the conscious course of action to move from a current state to a desired future end state) to ‘intended strategy’. Finally, the dynamic nature of the e-health setting has changed; aspects of e-health have been practiced in some countries for years, perhaps decades. e-Health has therefore passed its infancy and the level of turbulence is generally ‘low’ at this point. Similarly with the ever growing knowledge base available through the grey and scientific literature, our understanding of the e-health environment can be considered high. Relating these facts to Boisot’s matrix (Table 1), a low level of ‘environmental turbulence’ and high level of ‘understandability’ coincides with the ***strategic planning*** approach to strategy development.

Together, it can be argued that the ‘5 P strategy theory’, ‘deliberate and emergent strategy theory’, and ‘Boisot’s theory’, point towards ‘strategic planning’ as the optimal process to apply within health care settings. Adopting the ‘strategic planning’ approach provides a mechanism that allows a country, region, or health care organization to define its strategy and make decisions on allocating resources to pursue that strategy, and move towards integration of e-health into an existing health system in a way that supports evidence-based health needs of a given setting (e.g. country, sub national region, facility).

2.3 Available Insight on e-Health Strategy

This chapter begins with a summary review and critique of key examples available from the global literature in terms of e-health strategy or road maps at present. A ‘road map’ can be described as a plan that matches short term and long term goals with

specific technology solutions to help meet those goals (35). This section focuses on gaining some representative insight by reviewing examples of available e-health strategy documents from countries across globe. One important feature of this section is the 'reflection' part at the end of each strategy document. This 'reflection' was completed based on a checklist that facilitated consistent reviewing of 'e-health strategy documents'. The checklist addressed important components of an e-health strategy, such as presence of objectives, completion of a 'needs assessment', and consideration of other (non-health) determinants such as the political and legal environment to support e-health. Other components of the check list included any consultation process among stakeholders, development of an architecture, and infrastructure available (if applicable).

e-Health is a global concept so it is important to look at examples across different regions of the globe. One country each from the European Union (Romania), South American (Cuba), and African regions (Kenya) was selected for review of their e-health strategy documents. From North America, Canada was selected and different provincial strategy documents were selected as there is no single document that could be identified as 'the' Canadian e-Health Strategy. The rationale for selecting the above mentioned countries was either their mutual consultative process or their working towards a broader e-health effort encompassing all domains of e-health. Although the global list for e-health strategy documents at present is quite large (especially when including 'road maps'), every attempt was made to review representative 'strategy documents' from the global list. As this research was primarily to guide the conceptual formulation of the e-HSDF, available evidence was gathered to learn insight from across the globe and to gather

guidance and evidence for a conceptual framework. Finally, two recent documents intended to provide guidance in e-health strategy development that were recently published were reviewed and critiqued. The final part of the chapter presents findings from the literature regarding the concept of 'strategy' – what it is, and how it is developed.

2.4 Global Examples of e-Health Strategy

Europe as a region has been instrumental in formulating e-health strategy policy for the past couple of years for all of its member countries. The EU is moving slowly towards a "European e-health Area", (29) which signifies coordination of actions between e-health policies and stakeholders among EU countries. The following example of Romania as a country was mainly to demonstrate some of the challenges that can be found at the country level.

2.4.1 e-Health Strategy: Romania (European Union)

Romania is a semi-presidential democratic republic where president and prime minister share the executive function. It is composed of 41 counties and grouped into eight regions. The Ministry of Public Health is mainly responsible of creating the health policy along with regulations. Health reform law 95/2006 is the current regulatory law which establishes protocols, regulations and policies for health care institutions and personnel.

The Centre for Health Computing and Statistics (CHCS) is the lead organization in building the National Health Information System in Romania (also a lead organization in IT policy for the country) (36). Major reforms in the health structure have mainly addressed financial aspects and, as a result, an isolated independent system in the Romanian Health System emerged following the policy implementation. Initiatives included:

1) Health Management Information System (HMIS): Established with its components in the Ministry of Public Health (MPH) and National Centre for Organizing and Ensuring the Health Information System.
2) Health Insurance Information Systems (HIIS): The National Health Insurance System was implemented at the regional and national levels, together with other institutions like the military and transportation (61).
3) Healthcare Unit Information Systems: Introduced to hospitals, poly clinics, ambulance stations, drug warehouses etc.
4) Information Systems of Health Research and Education: Created information systems for other health care organizations, regulatory bodies, and professional associations.

In the year 2006, the "National Centre for Organizing and Ensuring the Health Information System" was created to stream line all the above independent projects. The e-health Strategy document for Romania reveals quite explicitly that the focus of the overall e-health strategy remains on the *interoperability* of the information system of the Ministry of Public Health and its divisions at central, regional, and national levels with

those of the public and private health insurance companies and other stake holders (37). The e-health strategy also explicitly mentions the following stated goal and vision for e-health: “to develop an integrated, unique, national patient oriented health information system, including an electronic health record and to assure the interoperability of the health information systems and data base existing in the Romania.”

Reflection:

There was a clear focus in the proposed strategy towards streamlining all the health informatics tools and applications with little use of health indicators in creating the e-health strategy. Also there is no insight on how the emerging health issues, especially the aging population and surge of chronic diseases, can be addressed by this e-health strategy.

2.4.2 Cuba’s National e-Health Strategy

The Republic of Cuba is an island in the Caribbean with a population of nearly 11 million. As a nation Cuba has excellent health and economic indicators with a low infant mortality ratio in 2005 of 6.1 per 1,000 live births (as compared to 6.8 per 1,000 live births in the USA). The life expectancy in Cuba averages 78 years in both sexes. Historically Cuba has ranked high in terms of medical personnel and has been a major contributor of medical personnel across the globe to nearly 40 countries in recent years (including, for example, Haiti). Primary health care, which is universally accessible by its residents, is widely available across the country. The main challenges that were reported

in the literature reflect low wages, out ward migration of health care professionals, lack of facilities and equipment, a shortage of essential drugs, and technological shortfall.

Cuba embarked on a journey towards creation of a national e-health strategy a long a time ago. The creation of 'The National Medical Sciences Information Center (CNICM)' in 1965 was the first major step in this regard. This institution mainly serves the purpose of gathering health data at a central location. The formation of the National Health Telematics Network (INFOMED) was another major achievement in this regard (38).

The salient features that were identified in the Cuban e-Health Strategy revolve around creation of a 'virtual health infrastructure' to help the health system in Cuba to collect, share, and transfer data between the national center and its peripheral poly clinics. The national guidelines rolled out in 1997 clearly establish the need for better coordination among different tiers of health systems.

The core principles of Cuba National e-Health Strategy are:

1) e-Health should be patient centered
2) Confidentiality must be maintained in transmitting data
3) Open source software is the base
4) Access should be equitable
5) The system should be sustainable
6) An evaluation process should be well identified

Reflection:

By reviewing the e-health strategy document of Cuba, it can be inferred that Cuba has achieved significant recent success in its primary health care system. Although Cuba has produced significant numbers of health care professionals, they are also facing the challenges of out migration of these trained resources. Cuba's e-health road map at present mainly emphasizes use of Health Management Information Systems. The main challenge the country foresees is the attainment of technological advancement at low cost. This strategy again lacks description of what health issues could be addressed by e-health interventions, if any, and at what cost to the countries overall economy. The predominance of health informatics also prevails in Cuba's e-health context similar to many other countries.

2.4.3 Kenya's National e-Health Strategy

Kenya's National e-health strategy document just came out last year (2011) after three year of effort at the National level (39). The strategy highlighted major objectives such as:

- To support more informed policy, investment and research decisions through access to timely, accurate and comprehensive reporting on Kenyan health system activities and outcomes.
- To improve the quality, safety and efficiency of clinical practices by giving care providers better access to consumer health information, clinical evidence and clinical decision support tools.

- To enable the Kenyan health sector to more effectively operate as an inter-connected system overcoming the current fragmentation and duplication of service delivery.
- To create linkages between health research and information technologies.

The document then touched upon five point implementation areas for its e-health strategy, such as:

1. Telemedicine
2. Health Information Systems
3. Information for Citizens
4. m-Health
5. e-Learning

The document also declared some guiding principles, such as good governance, partnership, privacy and common standards.

Reflection:

This is a good guiding document that reflects huge effort by many institutions and individuals in Kenya. The document did reflect on the challenges faced by the health system in Kenya (such as the double burden of disease, HIV prevalence, maternal and childhood illnesses) compounded by resource constraints, and a lack of infrastructure. The document also identified areas of implementation, but the main focus revolved around an "enterprise architecture building" theme (prior to any 'strategy'). A lack of

understanding was found in addressing how proposed "health informatics" infrastructures would be able to address the health challenges mentioned above. Guiding principles around good governance, partnership, privacy and common standards were also highlighted.

2.5 e-Health Strategy in Canada

As mentioned in the beginning of Chapter Six, currently there is no single document that can be identified as 'the' Canadian e-Health Strategy partly because of the fact that health follows a Provincial / Territorial mandate for service delivery. In this section, e-health strategies of three provinces are summarized (based on their journey in formulating objectives and consultative processes around e-health) to provide an understanding of e-health strategies from a developed country perspective.

2.5.1 e-Health Strategy for New Brunswick

The Government of New Brunswick's Provincial Health Plan (PHP) for the period 2008-2012 has envisaged extensive re-structuring of the health system including finance and human resources (40). The plans foresee a move from a "system centred health system to a patient centred system". The e-health strategy stems from information technology projects conducted within the PHP context.

The PHP required centralization of eight regional health authorities into two similar Regional Health Authorities (RHAs) - RHA A and RHA B. Another step was to create an organization called "Facilicorp NB"; a shared service provider institution to

address non clinical services within the health system. The establishment of the New Brunswick Health Council and New Brunswick Research and Innovation Council were other key objectives of the health plan. Facilicorp NB has a mandate to provide all IT and health informatics services for the province for collecting and data assimilation services.

The overall strategy revolves around a "one patient one record" theme. The most important component of the e-health reform was the interoperable Electronic Health Record (iEHR) which was intended to facilitate retrieving a patient health record anywhere in the province.

Reflection:

By reviewing the PHP document, the e-health strategy of New Brunswick province can be inferred. Its main focus is on health informatics without first taking into account the actual health needs of the province, and how the proposed e-health strategy would address these and be able to adapt in future.

2.5.2 e-Health Strategy for Ontario

e-Health Ontario is a provincial institution mandated in 2008 by the province of Ontario to formulate an e-Health strategy for the province. The agency released its strategy document entitled "Ontario's e-Health Strategy 2009-2012". The strategy is based on two main themes: Clinical and Foundational (41)

Clinical Priorities (includes three major components listed below):

- Diabetes Management: to control and manage diabetes more effectively and reduce associated complications and costs.

- Medication Management: to implement on-line management of prescription medications to minimize preventable adverse drug events.

- Wait Times: to reduce wait times in Ontario emergency departments, and the incidence of inpatients in acute care waiting for alternate levels of care, and to continue improving wait times for acute care.

Foundational Priorities (includes four components listed below):

- Cornerstone Information Systems: these systems are building blocks for information tools, and include services and registries that will enable clinical information to be captured and shared effectively and securely.

- Clinical Activity Information Systems: these systems will help clinicians to manage care at various points along the service continuum.

- Technology Services: these services will help the applications to run smoothly.

- Enabling Practices and Talent Management: these practices will help in implementation based on evidence. Furthermore, the organization wants to strengthen its electronic health record system in next the three years.

Reflection:

The e-Health Ontario strategy reflects a way to address clinical and technological component related to e-health. The strategy identified structured indicators in achieving the three clinical outcomes over a period of three years. In the entire document, it was difficult to understand how these clinical objectives were identified first and what the basis of prioritization was. Once again, the major focus is building high quality infrastructure and health informatics.

2.5.3 e-Health Strategy for British Columbia

An e-health strategy has been the foremost priority of the British Columbia Health System for several years. This stems from a broader goal and vision to have e-health integrated into the health system (42). Specific goals are for:

- A provincial electronic health record (EHR) to facilitate the seamless, secure and timely sharing of accurate health information
- Telehealth to enable broader, more equitable access to information and services in far remote areas
- Transformation of clinical practices by applying ICT within the health care system
- More effective service across the health system to those who are at higher risk
- Public health and self-managed care to ensure timely dissemination of health information
- Improved health care planning and stewardship based on evidence

The British Columbia health system has been instrumental in adapting several existing functions to achieve their goal. These were good governance, financial resource mobilizing and sharing, collaborative partnership among stakeholders, and use of existing resources available for the province.

Reflection:

This strategy document was more of a guiding tool, but lacked time bound objectives. One important thing is the Provincial privacy law which was laid down at the beginning

of their e-health journey to facilitate and guide the process, something unique within Canada.

2.6 e-Health Strategy Guidance

Two very recent documents, namely 'The Commonwealth Workbook of Methodologies, Content and Models' (published in 2011) and the 'National e-health Strategy Toolkit' (published jointly by the WHO and International Telecommunications Union in 2012) were identified; each is intended to provide guidance to countries in developing their e-Health Strategy. These are briefly described below.

2.6.1 The Commonwealth's Contribution

A recent workbook by Tom Jones entitled "Developing an e-Health Strategy: A Commonwealth Workbook of Methodologies, Content and Models", elaborates on the process of strategy building in e-health mainly for Commonwealth countries (43). Jones illustrates e-health as a core resource to strengthen health systems and to provide care to the population.

The main domains that are considered to comprise, e-health strategy building are:

1) Information gathering and sharing to support health care system and health care.
2) Implementation of ICT to capture and deliver the information
3) The need to implement a change model in work practice to realize the benefits.

This book reveals the work of many years of collection and collation of information, and creates a proto type e-health strategy proposal that can be used by member states. A great amount of detail was given with regard to general development of a country plan for: ICT infrastructure, mobile service, internet provision, and overall ICT development. Also emphasized was the need to set priorities and consider disease burden. This work book helps to understand the importance of leadership from all domains: clinical, executive, and political arenas. The last section of the workbook deals with financial viability of e-health projects and sheds light on the policy statements around e-health.

Reflection:

The key points in this workbook emphasize the following needs and perspectives when formulating a strategy: 1) health improvement and strengthening of health care, 2) ICT specific to e-health, and 3) affordability of e-health. It is a solid addition to the knowledge-base of documents relating to e-health strategy that are available globally. Although the work book emphasized gathering of baseline information to build the framework, it seemed to overlook the contribution of this data to determining the actual e-health deliverable. Furthermore it became more complex than simple which, ironically, was emphasized in the beginning of the work book. In addition, the introduction of policy sections without having strategy in place seems ambitious. Finally, in this complex setting the need to select appropriate e-health solutions to address appropriate health issues was absent.

2.6.2 WHO and International Telecommunications Union [ITU].

This year (2012), the World Health Organization in collaboration with the International Telecommunications Union published its "National eHealth Strategy Toolkit" (44). The rationale for producing this document was twofold. First, WHO promulgated a directive in 2005 which encouraged member states to formulate their own country specific e-health strategy, and second to help the member states by providing a set of tools to assist them in achieving this task.

The guiding principle in formulating this tool kit was for it to serve as a road map for coordinating national e-health activities and projects into a unified program. The idea was to involve major stake holders working in e-health to better coordinate and develop interoperability among national systems, aligning them with international standards. A special focus of the tool kit was to encourage telemedicine projects at the national level, with special emphasis given to capacity building of medical personnel.

The report is comprised of three sections:

1) Establishing a national *e-health vision* that responds to health and development goals
2) Developing a national *e-health action plan* that reflects country priorities
3) *Evaluating and monitoring* to manage risks

The key steps for the e-health strategy proposed in the document were:

1) Strengthening infrastructure
2) Strengthening e-health enabling environment
3) Scaling up and integration, cost effectiveness, and policies for privacy and security.

The national e-health vision as identified in the WHO tool kit begins with gathering of information regarding the national health system and health indicators. It then moves forward to address the health system needs that can be supported by e-health interventions. The last part of the strategy was to build infrastructure and policies around e-health. A great deal of information was proposed in building the information section like population health, work force distribution, leadership, challenges and funding sources. The main emphasis was on infrastructure, interoperability, regulations, telemedicine, Internet, and software licensing with regulations. A "high level stakeholder perspective model" was proposed which essentially tries to connect all the health informatics pieces in an "e-health architecture" like health information system, addressing access and security, health records, setting up of Internet in urban and rural settings, records retrieval, and diagnostic services information sharing.

Reflection:

This is a very detailed document which incorporates many key aspects in developing e-health programs for a given scenario. Good aspects include provision of a structured approach, and addressing many essential aspects in preparing for e-health

implementation. However, shortcomings exist: it is heavily health informatics biased, with little recognition of other important e-health elements such as telehealth or e-learning (e.g. Table 19 of the WHO-ITU document) and the e-health outcomes are not health-needs focused. For example: In Annex G of the WHO –ITU document at one point it was mentioned that ‘e-Health outcomes’ are defined as ‘What will be achieved or changed through using e-health, and how will the health system and services change: by improving the information flows within the health sector; improving electronic access to health services and information’. In other words, no consideration is given to asking for health needs based outcomes such as “reducing ‘x’ chronic disease by ‘y’ percent within the next ‘z’ years”. Furthermore, none of the toolkits three sections reference establishing an e-health strategy document.

Chapter 3: Study Rationale and Objectives

3.1 Study Rationale

e-Health is recognised to play a possible role for health care systems but still lacks sustainable integration into existing health care systems, especially in resource constrained settings (45, 46). Implementation of such undertakings requires careful planning well before the event, and should be guided by what is termed a 'strategy'. There has been a growing recognition of the need for 'strategy' to guide this process, as exemplified by the following quotes from three recently developed e-health strategy documents:

Australia National e-Health Strategy, 2008

> "The e-health strategy is commended as a useful guide to the next steps for Australia in its e-health journey. The e-health strategy is pragmatic, balances different priorities and will help to lead Australia towards the delivery of a safer, better connected and more sustainable health care system' (47).

National e-Health Strategy, Mauritius, 2010

> "Today, as we take stock of the current state realities, it increasingly emerges how ineffective piecemeal efforts can be. Failure to define an overarching national level strategy, in which the different ICT components must belong, robs initiatives of any sectoral ownership and leaves them at the hands of individual organizations. This

national level e-health strategy with almost a sector-wide participation and ownership is an effort to fill this gap' (48).

Kenya National e-Health Strategy, 2011

"There is a compelling need to devise ways and means of closing the gap between [health sector] vision and reality. This e-health strategy seeks to closing this gap…. [T]he development of strategy used a participatory approach that started in October 2008 and concluded in February 2011" (39).

3.2 Research Gaps

A detailed literature review (mentioned in sections 2.4, 2.5, 2.6 of this document) revealed relatively few e-health strategy documents across the globe. Those that exist are mainly from developed countries (the European Union in particular) and are mainly presented as 'road maps' based on stated objectives without describing any needs-based justification in identifying those objectives. These documents emerged across the spectrum of administrative levels such as the district level, sub national level (e.g. province, state, canton), and country level.

A common theme, and shortcoming, was that they started with a stated objective without giving any context or background as to why this objective was important in that particular health system and setting, and what proportion of predominant health system issues would be addressed by meeting the specified objectives (41). In addition, many e-health strategy documents from developed countries focused almost exclusively on

implementing solutions that revolved around health informatics, technology innovation, and Health Information Systems (HISs) (49). This is considered a shortcoming also, since all potential e-health solutions should be considered, as appropriate to answer the health needs identified in prior assessments.

Very few e-health strategy documents were found from developing countries (50). This includes Pakistan, suggesting the situation regarding an e-health strategy in Pakistan is similar to that of other developing countries. As of today, no clearly defined e-health strategy framework, plan, or even road map is available in most developing countries. Availability of a framework to assist in e-health strategy development would be welcomed.

Although Scott elaborated a conceptual e-Health Strategy Framework in 2007, this was based on personal experience with no theoretical support and lacked description of evidence-based tools for its implementation (51). A recent 'work book' on e-health strategy (as mentioned in section 2.6.1 of this thesis) from the Commonwealth identified some core steps towards formulating an e-health strategy, but did not capture some important aspects like culture, socio-economic and political volatility, or the telecommunications infrastructure in many developing countries (43). An even more recent contribution from the WHO and ITU (International Telecommunications Union) also in section 2.6.2, of this thesis provides a framework and method for the development of a national e-health vision, action plan, and monitoring framework but again focuses on health informatics which might not be most relevant to many resource

poor settings (44). Each of these shortcomings will be discussed in more detail elsewhere in the thesis.

This preliminary literature review demonstrated that clear gaps exist in the literature, and that despite the above guidance, there was no indication of a study examining the evidence-based design of an e-Health Strategy Development Framework (e-HSDF). Given that many developing countries are on the cusp of significant investment in e-health solutions, the lack of a clear e-HSDF to help policy- and decision-makers identify the most appropriate e-health solutions in their own context is a major concern. These are settings with extremely scarce resources, and they can ill afford to invest unwisely. This study provides an evidence-based e-HSDF for the developing country context, with hypothetical application using Pakistan as an example.

Findings of this research could be used by government, policy makers, NGOs, the private sector, donor agencies, and health care institutions. The framework may l allow Pakistan, and other developing countries, to address pertinent health issues, both in urban and rural settings, using appropriate e-health solutions.

3.3 Research Questions and Objective

This study focuses on designing an evidence based e-Health Strategy Development Framework, using appropriate and available tools for a developing country like Pakistan. In order to achieve this, three sequential questions must be answered.

1) What processes or steps might be required to formulate a country focused and evidence based e-Health Strategy Development Framework (e-HSDF)?
2) In what sequence should these processes be aligned to form a conceptual framework?
3) What published tools or approaches can be identified and recommended to assist in practical application of the processes or steps identified?

A broader aim was to assess if the tool would be functional within the developing country context. To achieve this, a hypothetical application of the final tool to Pakistan was performed.

Chapter 4: Methodology

4.1 Study Design

A four-phased methodology was adopted: 1) a structured literature review was conducted to identify existing e-health strategy [theory and] documents to provide content for the framework; 2) using this insight, a conceptual structure for content of the framework was developed; 3) a further literature search was conducted to identify existing tools that facilitate each stage in the proposed framework; and 4) the evidence was synthesized to formulate the complete e-Health Strategy Development Framework (e-HSDF). Although validation of (e-HSDF) was beyond the scope of this thesis, an assessment of utility was performed through a theoretical exercise to apply the (e-HSDF) to the Pakistan setting.

4.1.1 Literature review

Literature review in this study serves three main purposes. First, it provides the insight on available e-health strategy documents across globe. Second, it serves as the basis of evidence based enquiry for the conceptual map of e-health strategy framework. Third, it facilitates in finding the appropriate tools at different stages of e-health strategy framework. The literature review methodology and findings has been described in detail in chapter 2 of this thesis.

4.1.2 Conceptual Framework

A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought (52). It is an organized way of

thinking about how the activities in a given project are planned based on available evidence. Using the 'index' literature findings a 'preliminary conceptual framework' was designed based on the work by Scott in 2007 (51), and subsequently reviewed and revised, before finalising the e-HSDF.

4.1.3 Literature Search – Available Tools

This third literature search was intended to identify existing tools that might facilitate each step in the proposed e-HSDF. That search was performed using the Ovid Medline plus a review of grey literature using the Google search engine. Individual searches of the literature were conducted pertaining to different stages of the draft conceptual framework, such as: holistic analysis for other determinants, health needs prioritization, and e-health solution.

4.1.4 Application of Framework in context of Pakistan

Once all the evidence-based insight had been gathered from the literature, it was synthesised and applied to the draft conceptual framework in order to develop the preliminary, and subsequently the final e-HSDF, based upon the context of Pakistan the final e-HSDF was applied as a means of testing the Framework to determine its usability.

4.2 Ethical Consideration

The revised research proposal was reviewed and approved by the Conjoint Health Research Ethics Board (CHREB) at the University of Calgary, Alberta in January 2012. After the approval the study was initiated.

4.3 Establishing a Context

To aid in development of a meaningful framework, it was felt appropriate to identify a country whose context could be used as a backdrop to the study, allowing ongoing reflection on the practical utility and value of the Framework as it was developed. The country selected was that with which the researcher was most familiar – Pakistan.

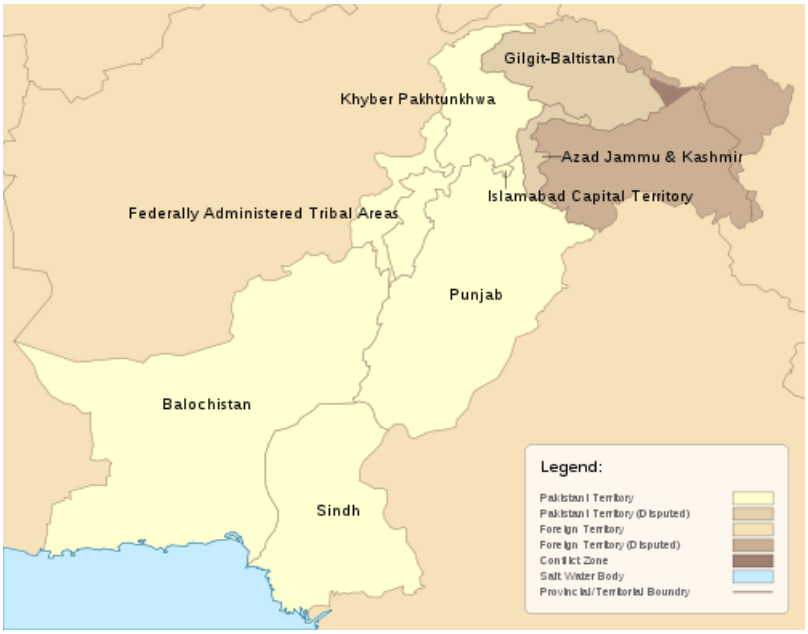
4.3.1 Introduction to the Pakistan

Pakistan, officially The Islamic Republic of Pakistan, is the sixth most populous country in the world. It is located at a strategically important region of South, Central and Western Asia Pakistan is bordered by India to the east, Afghanistan to the west and north, Iran to the southwest and China to the far northeast. It has a 650 miles coastline along the Arabian Sea and the Gulf of Oman to the south (53)

Pakistan is a federal parliamentary republic consisting of four provinces (Punjab, Sindh, Baluchistan and Khyber PukhtunKhwa) and four federal territories. A country of nearly 180 million people, Pakistan is characterized by its ethnically, culturally and linguistically diverse population and its varied geography. It has a semi-industrialized economy with nearly 50% of the population living in rural areas with associated agricultural activity contributing one-fourth of the gross national product (GNP) (54). The other leading sectors are manufacturing and services. Pakistan is also gradually moving from basic industries to a high paced information based economy (55).

Figure 4: Location of Pakistan in the world.
[Internet reference. http://en.wikepedia.org/wiki.org/File:Pakistan (orthographic projection).svg. Accessed on November 15, 2012]

Figure 5: Map of the country of Pakistan.
[Internet reference: http://en.wikipedia.org/wiki/Pakistan . Accessed on November 15, 2012]



4.3.2 e-Initiatives in Pakistan

At the beginning of the century (2003-05), under the mandate of the World Summit on the Information Society (WSIS), the Government of Pakistan started many initiatives (56). The first e-Government 5 year plan was developed in 2005 by The Electronic Government Directorate (EGD), approved by The National E Government Council (NEGC), and endorsed by The Federal Cabinet at that time. This 5-year plan mainly emphasized infrastructure, general and specific applications related to information technology, setting standards, and creating an enabling environment to promote information technology in the country (57).

4.3.2 Health in Pakistan

This brief background of the journey of e-Government in Pakistan helps in understanding the potential role of an e-Health strategy to address health sector issues. When considering basic health indicators in the region Pakistan is lagging behind considerably (57). The country exhibits a wide range of inequalities, and poor access to health care in its large geographic area. It is facing many burdens in health care, with the health system unable to reduce infant mortality below 76 per 1,000 live births, and concurrently seeing an increase in prevalence of chronic diseases in an aging population (58). The struggle to overcome such challenges is reflected by the poor delivery of health care services, especially in rural and underserved areas (59). Natural disasters also take their toll, with the recent flood in the summer of 2010 across all four provinces of Pakistan aggravating this scenario to an extreme (60). In addition, the situation is compounded by a large migrant population, which is very unique to this country.

Pakistan is the host of nearly 4 million refugees from Afghanistan after the Russian-Afghan war in 1979.

According to State figures there are still 1.7 million registered Afghan refugees in the country which seriously strains health service delivery in the country (61). There is another type of migration also witnessed in the country. Since 2009, nearly 300,000 Internally-Displaced Persons (IDPs) have migrated from one district of Pakistan to others due to safety concerns (poor local law and order) which again has a serious impact on the existing health system (62).

4.3.3 e-Health in Pakistan

Like many countries around the world, Pakistan has experienced implementation of a number of e-health activities as 'pilots' or research endeavours. But the country is facing huge challenges in health care delivery to its population of diverse cultures living across a large geographical area. The Constitution of Pakistan mandates that health care is a resource for every citizen irrespective of their geographical place (63). Limited budget and a lack of human resources compounded by accessibility issues (especially in rural areas) are some of the factors that aggravate the scenario (59). Recently, policy makers in Pakistan engaged in a dialogue identifying that e-health can be one of the viable options to address some of the health care service delivery issues in the country (64). This need was highlighted again in the e-health readiness assessments of a few health care institutions in Pakistan in recent years (65).

4.3.4 Creation of e-HAP in Pakistan

One major mile stone in the history of e-health in Pakistan was the creation of the e-Health Association of Pakistan (e-HAP) in 2009, stimulated by one of the recommendations from the Rockefeller conference series in Bellagio. It was a joint effort by a group of university faculty members, government officials, and organizations working mainly in telemedicine. The main mandate of e-HAP is to increase knowledge and to advocate policy and guidelines for coordinated efforts among different stakeholders for e-health in Pakistan (66).

Chapter 5: Development of a Conceptual Framework

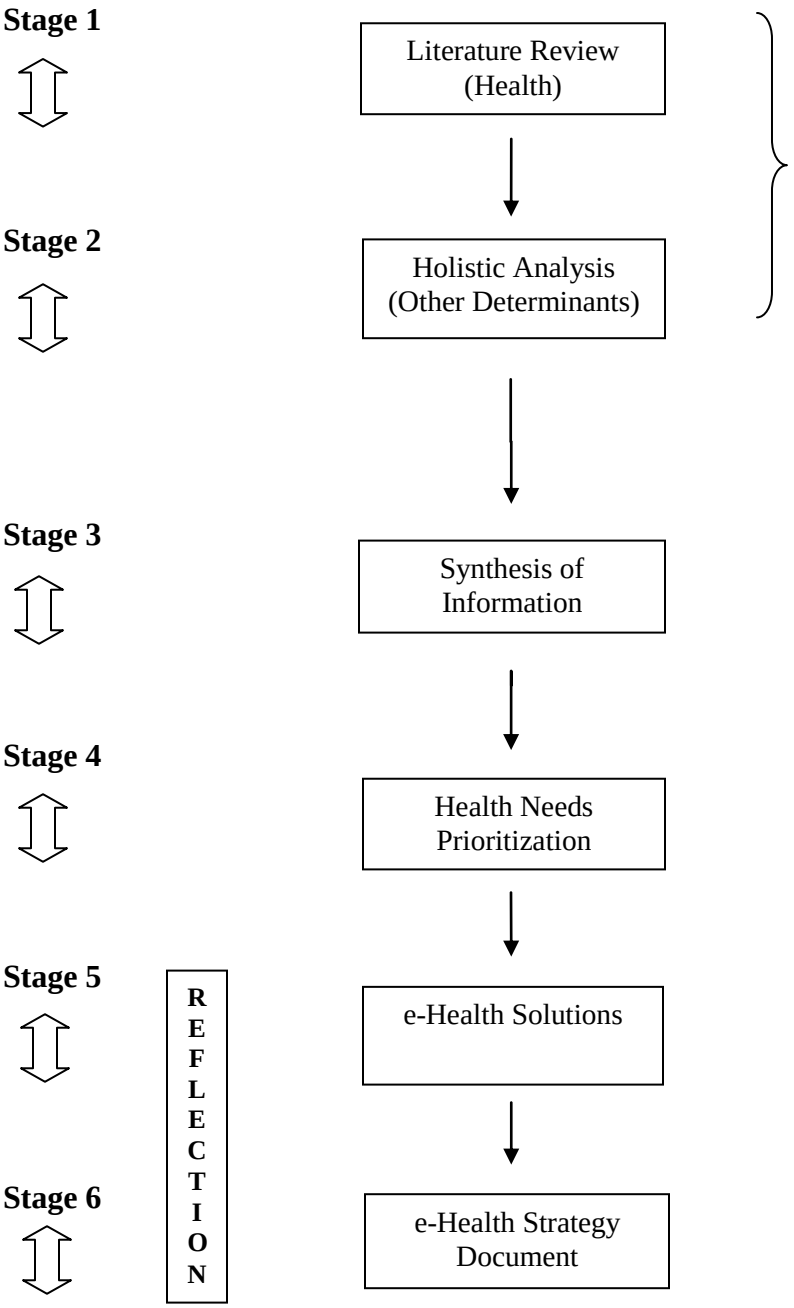
The conceptual framework was built on the strategy concept paper proposed by Scott in 2007(52). Scott elaborated the strategy process as an exercise of evidence gathering along with needs assessment and priority setting. This research further refines the strategy formation process by incorporating evidence based tools along with collation of information.

Based upon the available evidence (grey and scientific literature from the first search), steps for a preliminary e-HSDF was created. Figure 6 illustrates the conceptual framework of e-health strategy development model. This framework consists of six stages with the final stage comprised of synthesizing the e-health strategy document based upon evidence from the preceding stages. These six stages are:

1) Literature Review
2) Holistic Analysis for Other Determinants
3) Synthesis of Information
4) Health Needs Prioritization
5) e-Health Solutions
6) e-Health Strategy Document

A description of each stage is given below, within which a discussion of potential tools identified from the literature is included.

Figure 6: Preliminary e-Health Strategy Development Framework



5.1 Stage 1. Literature Review (Health Scenario)

A literature review provides an overview and a critical evaluation of a body of literature relating to a research topic or a research problem (67). The literature review in this research serves to provide an opportunity to review e-health strategy documents across the globe. It also helps in gathering evidence for the conceptual framework, and in reviewing possible tools that could be used in each stages of the conceptual framework.

Here, the literature review and 'document review' would be completed in order to review evidence related to the health situation for any given country, region, or institution in the form of official or un-official reports. Much of this evidence already exists in the form of country national health policies, fact sheets, reports, and surveys. The major sources for gathering such data are:

1) National Health policy of a given country
2) Country specific World Health Organization report
3) National Health report of a given country
4) Other relevant policy/strategy documents issued by the Government
5) Situation analysis of Health needs documents pertinent to any country

The body of evidence gathered from the above mechanism helps in understanding the current health scenario of a given geographical setting.

5.2 Stage 2. Holistic Analysis for Other Determinants

The first stage gathers basic information with regard to health status of the population of a country, but this is often inadequate in formulating an appropriate strategy. Stage 2, then signifies the process of gathering evidence outside the context of health; more precisely it helps in understating the broader determinants that influence health within a given scenario. Holistic analysis as a method of gathering evidence was described by Scott in 2007 (51). Many evidence based tools that were available in the literature were reviewed for this particular research. These include SWOT (Strength, Weaknesses, Opportunities and Threats) analysis (68), TOWS (Threats, Opportunities, Weaknesses and Strength) analysis (69), PESTEL (Political, Economic, Socio-cultural, Technological, Environmental and Legal) analysis (70), and PEST (Political, Economic, Socio-cultural Technological) analysis (71). The major difference between SWOT and TOWS is that TOWS focuses more on the external environment while SWOT emphasizes the internal environment of an organization. Both PEST and PESTEL help in analyzing the broader environment for the strategy building exercise. For this current research and e-HSDF development, PEST analysis was selected as the evidence based tool to gather information about other determinants in the Stage 2 of Holistic Analysis. This decision was based on the fact that Environmental and Legal determinants can also be reviewed under other categories with presence across the board.

PEST Analysis is a widely accepted tool for analysis of determinants that helps in providing a broader perspective of issues that affect strategy (72). PEST analysis has been used in the health sector for hospitals in the United Kingdom as part of annual

strategy planning within the National Health Service (NHS) (73). Strategy building needs evidence from other key determinants from the outset in order to move in the right direction. This stage facilitates understanding of broader issues, 'on the ground' realities, and the role of other factors that may impact formulating a strategy framework. The key issue is that, if strategy is conceived without the input of the current political, economic and socio cultural reality it will have far less ability to be sustainable.

5.3 Stage 3. Synthesis of Information

A unique contribution of this research study is the creation of a matrix that presents the available evidence from the synthesis in a tabular form (74). Evidence gathered in the previous stages was collated, analyzed, and summarized, allowing the key information from different components to be placed in one location for retrieval, review, and use. The matrix was created based on the evidence collected in Stage 1 and Stage 2 to assist in identifying health needs at this particular point in time for the given geographical setting (Table 2).

5.4 Stage 4. Health Needs Prioritization

Health needs prioritization is a key step for the whole framework. Health needs prioritization is completed once all the data has been gathered in regard to the health needs and setting. This stage takes into consideration all the evidence that has been gathered in the previous stages to make a health priority list for a given region, province or country. Priority setting with limited resources is always a challenge in health care systems. Policy makers are responsible for making important decisions in allocating

Table 2: Synthesis of Information (Matrix Formation) for Stage 3

Stage 1				**Stage 2 (PEST Analysis)**			
Literature Review (Health)				**Political**	**Economic**	**Cultural**	**Technological**
Ovid Medline	National Health Policy	WHO Country specific health reports	Situation analysis of health needs	Political determination for health	National Health spending	Socio Cultural	ICT Investment
				Government Stability	Economic scenario	Literacy	Tele density
				Legislation pertaining to e-Health		Special groups	Broadband Connectivity
				Legal guidance		Demography	Computer Systems
							Human resource
							ICT language barrier
							Environmental impact

public funds to address health care issues, but often decisions are not made on rational thinking (75). The fact is that resource allocations in health care are complex and multipronged and ad hoc decisions are often the main mode of priority setting (76).

Considerable data exists as far as criteria or factors that play a key role in priority setting for a health care system. Among those the top most is a country or region's desire

to provide health benefits to the larger population (77). Second is the distribution of health benefits that are needed the most, e.g. for vulnerable populations (78), and women and child healthcare (79). The issue of selective preference by virtue of prevalent diseases is another consideration; their seriousness, financial constraints, and preventive vs. curative health care opportunities (80). One must not underestimate the significance and impact of critical decisions made by any government based primarily on political grounds (81). Directives of independent funding agencies remains a challenge for a developing country in its resource allocations, as these decisions might not be aligned with the national priority (82).

There has been a series of efforts put forward in the last decade to promote rational priority setting across the globe. In the beginning of 1990's the World Bank proposed *cost effective* considerations as the main method of priority setting in developing countries so that interventions are effective and available at low cost (83). This was simultaneously followed by the "*burden of disease"* model in the same era. This implied that the exercise of priority setting should be aligned with the morbidity and mortality indicators of a given country and priority of intervention should be based on disease severity (84, 85). There are three major frameworks that have prevailed in the last 2 decades with respect to priority setting in health care systems. These are described below.

5.4.1 Program Budgeting and Marginal Analysis" (PBMA)

Program Budgeting and Marginal Analysis (PBMA) is a tool to aid decision makers in setting priorities for the provision of health services. It is based on principles of *allocative efficiency* that means both the costs and outcome from the health services should be considered in planning (86). Program budgeting involves fragmenting the health services in a geographical area, hospital or clinical unit into a set of programs. These programs must have clear health-related objectives. Marginal analysis provides a measure of determining what benefits would be gained or lost by each particular intervention.

5.4.2 Accountability for Reasonableness

Health systems most of the time struggle with the issue of meeting the health demand of the population within prevailing resource constraints. Accountability for Reasonableness is a framework of priority setting that involves transparency in regard to priority setting decisions. It addresses the process of appealing to the rationale of making decisions and process of revising the decision in case of barriers to implementation (87). Primarily it consists of four conditions such as publicity, relevance, appeals, and enforcement. Recent evidence in Tanzania identifies certain factors that limit proper implementation in actual real-life scenarios. Some of the factors that were reported include a low level of public awareness, unreliable funding, inadequate accountability, and limited local resources (88).

5.4.3 Multi Criteria Decision Analysis (MCDA)

Another approach is fairly recent, and entails the use of multiple criteria in decision making. MCDA offers a unique way of analyzing a set of conflicting pieces of information in establishing preferences between available interventions/options by reference to an explicit set of stated objectives. MCDA facilitates creation of a rank order list of possible intervention based on available resources, which can be presented as a 'Performance Sheet' (89).

The performance sheet comprises of rows and columns where each row describes an option and each column describes the performance of each option by certain criteria like cost, access, coverage, and adaptability (89). The main purpose is to construct a frame of reference which represents preference for each option and weigh their relative importance. In the end a numerical list can be generated which reflects most of the possible scenarios to be addressed during the next stage of the strategy building process (Table 3).

Table 3: Example of a performance sheet for developing a health need priority list

Health Issues	**Appropriateness**			**Impact**		**Capacity**			**Total**
	Fit with mandate	Fit with leadership	Fit with donor agencies	Number reached	Expected degree of change	Human skills available	Technological skills available	Financial cost	

Scale: 4=Excellent, 3=Very Good, 2= Good, 1= Poor

5.5 Stage 5. e-Health Solution(s)

This stage is necessary in order to match the appropriate e-health solution(s) with the already prioritized health issues. One additional point that should be kept in mind is that stage 5 also reflects the mutual consultation of stakeholders that will have occurred to identify and prioritise the 'health issues'. Such consultations should be in the form of brain storming sessions and / or key informant interviews.

This stage helps the implementer in determining what priority areas in health care could be addressed by an e-health solution, incorporating all considerations such as political, financial, human resource, socio-cultural and technological aspects. In section 1.2 different domains of e-health were mentioned such as telehealth, health informatics, e-learning, and e-commerce. Keeping in view these four possible e-health solution domains another table was created (Table 4). This matrix serves as a guiding tool for a country by displaying what e-health solutions might address pertinent health issues. Recall that before this stage, the priority of health issues has already been established by the priority setting exercise. Thus this framework helps policy makers to not only identify the priority health issues based on best available evidence, but also then align these with appropriate e-health solutions.

For example, various options can be identified within each of the identified domains. Within 'telehealth' some examples might be teleconsultation (e.g. video conference or store and forward consultation between a health care provide and patient), teleradiology, telepathology, or telesurgery. In 'health informatics' some examples would

include Picture Archiving and Communication System (PACS), e-prescription, electronic health record, patient identifier, laboratory information system, disease surveillance, or vaccination records. 'e-Learning' could include learning for health care providers (in terms of continuous medical education (CME) or continuous professional development (CPD)), or for patients, families and the general population (health education and health awareness portals as some examples). 'e-Commerce' could include e-billing, inventory management systems, or electronic fund transfer within a health system (Table 4).

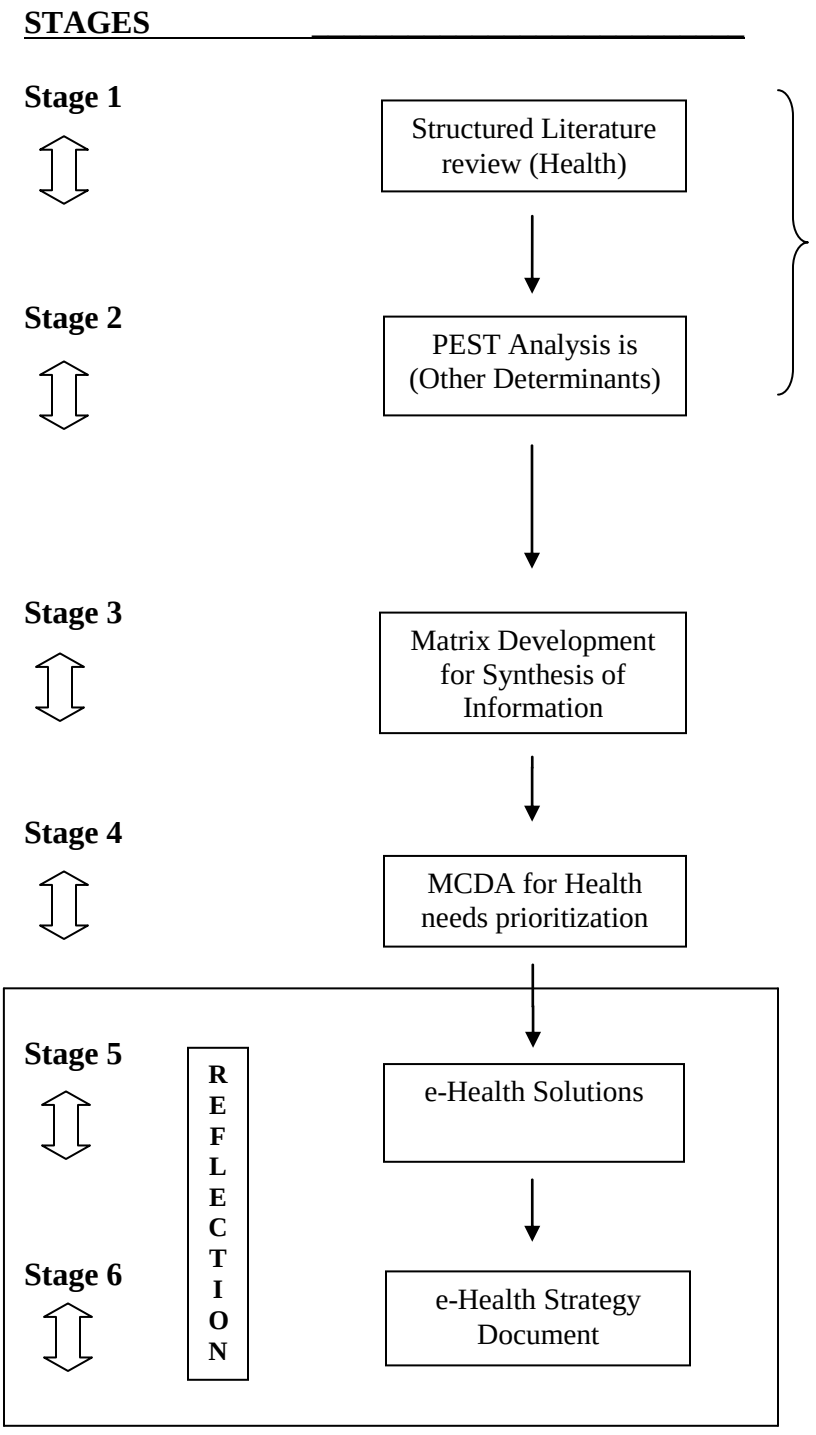
Table 4: Possible e-health solutions that could be used to address health issues

Possible e-Health Solutions			
Telehealth	**Health Informatics**	**e-Learning**	**e-Commerce**
Teleconsultation (e.g. video conference or store and forward consultation) Teleradiology Telepathology Telesurgery and other clinical domains Disease management at various stages	Patient Identifier Surveillance Vaccination record Cancer registry Laboratory and drug information system PACS Electronic health record	Importance of health education through electronic media m-Health for tracking doses m-Health for health information Health care provider education via CME's	Inventory of doses e-Billing Inventory of drugs

5.6 Stage 6. e-Health Strategy Document Development

By completing the steps as outlined above, a 'Final e-Health Strategy Development' process is created (Figure 7), and the subsequent document created will be based on the best available evidence and incorporate all the factors that ensure its effectiveness in the existing health system. It should be noted that this framework needs to be completed with further consultation of the stakeholders of any given country or region so that the e-health strategy document is 'owned' by the people who will be implementers in that country or region. Another important aspect t is that all the stages need to follow in the sequential order described and presented in Figure 7 - every stage helps in building the groundwork and insight necessary for the next stage. Of final note is the "reflection phase" noted in Figure 7. This "reflection phase"ensures a feedback mechanism to incorporate suggestions that arise from the stake holder consultation process. If developed as described. this framework will help avoid duplication of resource use in a given health system, and also encourage improved coordination among different stakeholders within an organized system.

Figure 7: Final e-health Strategy Development Framework



Chapter 6: Hypothetical Application of the Framework

This chapter explains the hypothetical application of the framework in the context of Pakistan to understand its utility. This chapter begins with a list of documents that were reviewed in order to understand the current health status of Pakistan, in order to complete Stage 1. The next stage (Stage 2) was to gather evidence in terms of PEST (Political, Economic, Socio-cultural and Technological) analysis for Pakistan. Synthesis of available information with the help of the new matrix (Stage 3) was the next logical step. This was followed by hypothetical priority setting (Stage 4) with possible e-health solutions (Stage5). This process would help in capturing many diverse aspects of Pakistan's setting, leading to suggestions of what e-health solutions are feasible and appropriate for the given scenario, thereby helping stakeholders in Pakistan to formulate an e-health strategy document.

6.1 STAGE1: Literature Review

As outlined in the matrix for an e-health strategy framework, country specific health related documents were reviewed in order to have a better understanding of the Pakistan setting and hence allow formation of an e-health strategy. The following documents were reviewed in order to get a broader picture of the situation from the Government perspective:

1) National Health Policy of Pakistan, 2001
2) National Health Policy of Pakistan, 2011 (draft)
3) National Economic policy of Pakistan, 2011
4) Health Management Information System of Pakistan (HMIS)
5) Ministry of Pakistan Information Technology, Pakistan
6) Ministry of Science and Technology, Pakistan

6.1.1 National Health Policy of Pakistan

The current effective health policy entitled "Agenda for Health Sector Reform" was announced by the Ministry of Health in 2001 (90). This National health policy identified 10 key areas as their main focus:

Health Policy: 2001

1) Reduce widespread prevalence of communicable disease
2) Address inadequacies in primary/secondary health care services
3) Remove professional/managerial deficiencies in the District Health System
4) Promote greater gender equity
5) Bridge basic nutrition gaps in the target population
6) Correct urban bias in the health sector
7) Introduce required regulation in private medical sector
8) Create mass awareness in Public Health matters
9) Effect improvements in the drug sector
10) Build capacity for Health Policy Monitoring

It is worth mentioning that many of the key areas do not have any strategies outlined in the document and use of technological interventions was not on the priority list in the policy.

6.1.2 National Health Policy of Pakistan (draft)

The most recent National Health Policy of Pakistan is still in draft form and was only ratified by the Cabinet in October 2012 (91). The key strategic areas are:

1) Provide and deliver a basic package of quality Essential Health Care Services
2) Develop and manage competent and committed health care providers
3) Generate reliable health information to manage and evaluate health services
4) Adopt appropriate health technology to deliver quality services
5) Finance the costs of providing basic health care to all Pakistanis
6) Reform the Health Administration to make it accountable to the public

The only statement that positions e-health in the policy is in the use of telemedicine under key area # 4 which envisions strengthening of the service provision component and using telemedicine as a tool to improve linkages between different tiers of the health system. Key area #3 will help in streamlining the National Health Information System at the district level and use of information in decision making. The strategy also highlights the future role of e-health in the country, but development of a strategy or road map was not described.

6.1.3 Health Management Information System of Pakistan (HMIS)

The Health Management Information System (HMIS) of Pakistan was developed in the early 1990's with a vision to strengthen the primary health care system mainly at the primary care level and at the taluka (Union council level). These were developed to share information about health indicators for communicable disease from the primary to tertiary level. A huge amount of time and effort was spent on data generation and reporting, but due to the lack of capacity and disintegration, this information was seldom used for decision making (92). One initiative in recent years was made towards establishing tertiary hospital health information systems in isolated settings.

This initiative is the proposed guidelines for an HMIS in Pakistan. The main thrust of the proposed policy is the setting up of District Health Information Systems with development of a standard mechanism for collection, collation, and analysis of information with concurrent sharing among different tiers of the health system. These include data sanctity, privacy and retrieval plus notification when required. This exercise will bring various national vertical programs into a unified system to make decisions based on evidence and findings. Another important aspect is formation of a national integrated disease surveillance system for communicable diseases and also management systems for non-communicable diseases.

The challenge remains the same - to integrate and utilize the health information for decision making purposes. The delay in synthesis of pertinent information leads to delay in taking decisions in a timely manner.

6.1.4 Ministry of Information and Technology

The Ministry of Information Technology (MoIT) has a Federal mandate to initiate and oversee the initiatives under Information Technology and Tele communications. This Ministry was established in 2002 after merging the Science and Technological Research Division and IT and Telecom Division (93). The Ministry was instrumental in creating Universal Service Policy in 2005 which is based on the need to ensure simultaneous growth in telecoms (including teledensity and broadband across the country). The policy directives of the Universal Service Policy are:

1) To make available and affordable voice telephony and data services suitable for internet access to progressively greater proportions of the Pakistan population at their home locations.
2) To provide a conducive atmosphere in increasing the investment in the sector.
3) To spearhead the broad band services across country

However, the Ministry has not been able to develop a strategy document, particularly in the context of e-health. However, very recently their policy document reflected application of e-health by a statement that nationwide e-health would be implemented in the near future. No details, purpose, or objectivity were provided with regard to the capacity and needs of the health system from a broader perspective, and the statement mainly stressed the need to exchange medical information through technology implementation.

6.1.5 Ministry of Science and Technology

This is one of the oldest Ministries at the Federal level in Pakistan and has been functional since 1972. Its main purpose was to initiate, advise, promote, and coordinate scientific and technological programs as per national agendas and guidelines (94). It has four major domains: (i) coordination and implementation of national science and technology policy; (ii) promotion and coordination of research and utilization of the results of research; (iii) development, production and utilization of nuclear energy; and (iv) coordination of utilization of scientific and technological manpower. This Ministry has supported several telemedicine initiatives with involvement of educational institutions like COMSATS Institute of Technology and health institutions like Jinnah Post Graduate Medical Centre in Karachi (94).

6.1.6 Health Situation Analysis

The health situation of Pakistan is similar to the health profile of any developing country with high population growth and a gradual movement towards the double burden of disease (i.e. both communicable and non-communicable diseases). Among major communicable diseases are diarrhoea, acute respiratory tract infection and vaccine preventable diseases like measles, hepatitis C, and tetanus. Low birth weight and malnutrition are other important causes of disease burden among children. Other major diseases include tuberculosis, malaria and typhoid. The estimates for tuberculosis are alarmingly high at 177 cases per 100,000 people per year. Injuries and accidents account for more than 11% of the total burden of disease.

The maternal mortality rate (MMR) is also high with estimates at 350 per 100,000 live births. A low rate of skilled birth attendance, poor access, and a lack of awareness along with culture are cited as the main contributing factors. Pakistan is still considered a low prevalence country in terms of HIV /AIDS, but concentrated pockets of burden (especially among intravenous drug users and the trucking industry) are recently reported.

Non communicable diseases on the other hand are continuously on the rise. Among the chronic disease component. the major players are diabetes, hypertension and cancers, especially lung and oral. The indicators for health also vary considerably among provinces and in rural and urban scenarios, with Baluchistan province lagging behind on many indicators (95).

Pakistan has a high fertility rate with 4.2 million new births annually. This rapid population growth will further strain an already overstretched and underperforming health care services delivery system, including deliveries by skilled birth attendants. Efforts made over the years to improve health standards have been partially neutralized by the rapid growth of the population. In addition, gender bias and limited access to health services further compromise health of Pakistanis (95). Table 5 summarizes Stage 1 of the hypothetical application of the e-HSDF for Pakistan.

Table 5: Hypothetical application of the e-HSDF to Pakistan (Summary of Stage 1)

Stage1 Literature Review (Health and Health Services)			
National Health Policy/ies	**Country Specific WHO reports**	**National Health Reports**	**Published articles**
1) No clear policy directive	1) Increase in childhood vaccine preventable disease	1) Increase incidence of Tuberculosis	1) Increase in childhood illnesses like pneumonia, diarrhea and others
2) e-HAP expressed keen interest	2) Difficulties in Polio vaccination by various factors	2) Increase in cancers attributable to tobacco	2) Chronic disease burden increases
3) Draft policy mentioned telemedicine as one area of interests	3) High maternal mortality rate among South East Asian countries	3) Increase in prevalence of chronic diseases	3) Prevalence of tobacco smoking is on a rise
4) Ministry of IT: No directive on e-health, but envisage to increase broad band in country			
5) Ministry of Science and Technology wants research should be widely disseminated			

6.2 STAGE2: PEST Analysis

Political Directions

6.2.1 National Political determination

There seems no clear activity regarding health in general and e-health in particular that can be inferred from Government statements in recent months. The National Health Policy is still not ratified by Government till November 2012 and there is no update on how the Government wants to move forward in this direction.

6.2.2 Government stability and anticipated changes

The Government of Pakistan has been stable for almost five years post military rule. The current parliamentary democracy is moving ahead and hopefully will continue its complete term until March 2013 (96). The present Government has already completed four and half years of its regime and based on constitutional grounds the next general elections could be called any time between September 2012 and March 2013. The security situation in large parts of the country is fragile affecting the policy environment and distribution of key primary care programs

6.2.3 Legislation pertaining to e-Health

With the restructuring and devolution of the Ministry of Health, the provincial health ministries are taking a lead on health policies and programs. Two provinces, Khyber Pakhtunkhwa and Punjab have identified e-health as their priority areas to work.

Economic indicators

The terms ‘economics’ and ‘health’ are interdependent to a certain extent. There is sufficient evidence that investing in health through evidence based analysis helps in economic development of the country in the long run (83). According to recent World Bank reports Pakistan is categorized as a low income country with a gross domestic product (GDP) of about $ 211 billion. Nearly, one third of the population (nearly 60 million) in Pakistan lives below the poverty line at present (97).

6.2.4 National Health Spending

Pakistan lags behind in health spending when compared to other countries of the region. The total annual health expenditures are around US$ 3.0 billion or nearly 2% of the national GDP. Government contribution is only 0.6 % of the total spending while the remaining difference is covered through out of pocket payment by citizens at health facilities, mainly for curative care. The donor funding allotted to health contributes nearly 8% of the total health spending, which is also less as compared to average donor assistance of 14 % for other countries of the region (98).

6.2.5 Current economic scenario

The Cabinet has passed a federal budget worth Pak Rs 3203 billion (1 US $= 94 Pak Rupees; ~ $34 billion US) in June of 2012 with a deficit of more than 1.0 trillion pak rupees (99). The approximate allocation towards health is a small amount of approximately 6.5 billion Pak rupees for a country with inhabitants of more than 170 million people over a wide geographic area. Most of the federal budget was allotted to debt servicing, military expenditure, and public sector development programs. In 2012 the Government of Pakistan received nearly US $ 1.4 billion from the USA under a coalition support program (100).

Public sector expenditure on health will be increased in line with the Fiscal Responsibility Act of 2005. At present, public health expenditures are 0.6% of the GDP. In the first stage, efforts will be made to increase public sector health expenditures to 0.85% of the GDP by 2011/12 and later on above 1.5% of the GDP by 2015.

Socio-cultural context

6.2.6 Socio-cultural Context

Pakistani society is largely multilingual, multi-ethnic, and multicultural. Though cultures within the country differ to some extent, more similarities than differences can be found, as most Pakistanis are mainly of Aryan heritage or have coexisted side by side along the Indus River for several thousand years, or both. However, with over 60 years of integration, and with a literacy rate of 55% (up from 3% at the time of independence), a distinctive "Pakistani" culture has sprung up, especially in the urban areas where many of the diverse ethnic groups have coexisted. Traditional family values are highly respected and considered sacred, although urban families are moving to form nuclear families, owing to socio-economic constraints imposed by the traditional culture of the extended family (101).

There are differences in culture among the different ethnic groups in matters such as dress, food, and religion, especially where pre-Islamic customs differ from Islamic practices. Pakistan was the first region of South Asia to feel the full impact of Islam and has developed a distinct Islamic identity, historically different from areas further west.

6.2.7 Literacy

Education in Pakistan is overseen by the government's Ministry of Education and the provincial governments, whereas the federal government mostly assists in curriculum development, accreditation, and in the financing of research. Article 25-A of the Constitution of Pakistan obligates the state to provide free and compulsory quality

education to children of the age group 5 to 16 years (102). “The State shall provide free and compulsory education to all children of the age of five to sixteen years in such a manner as may be determined by law”. The literacy rate is 59% in three provinces (Sindh, Punjab and Khyber Pakhtunkhwa) and nearly 45% in the Baluchistan province (103). One who can read a newspaper in their local language and write a simple letter, (in any language) was categorized as literate by national standards. The public spending on education is near to 1% of total GDP.

6.2.8 Special Groups - Afghan Refugees

Afghan refugees are mostly refugees who fled Afghanistan during the 1980s Soviet war and include people from all ages and professions. As of March 2009, some 1.7 million registered Afghan nationals were reported to be living in Pakistan, with the majority of them in Khyber Pakhtunkhwa, FATA, and northwestern Baluchistan (104). Many of them were born and raised in Pakistan in the last 30 years but are still counted as citizens of Afghanistan. Those designated as refugees are under the protection and care of the United Nations High Commissioner for Refugees (UNHCR), and provided legal status by the Government of Pakistan to stay in the country.

6.2.9 Demography

Pakistan’s estimated population in 2012 is around 180 million making it the world's sixth most-populous country (105). A fourfold increase in population was seen in the period 1950–2010. Pakistan has experienced a high fertility rate for the past couple of

decades with the current rate of 1.6% (2010). In the past, the country's population had a relatively high growth rate that has changed by moderate birth control rates.

Technological challenges

6.2.10 Investment and ICT culture

Pakistan has witnessed a huge foreign investment in the telecom sector, close to US$ 9 billion during the time period 2004 to 2007. The telecom sector is still the leading tax contributor to the country's economy (106). This reflects an obvious huge opportunity of ICT expansion in many domains. ICT expansion capitalizes both on the urban and rural scenario with mobile networks having reached very remote parts of the country. The country is currently in the process of contracting for a 3G network across the landscape. This development has potential to change the health access for the population of Pakistan if appropriate e-solutions are applied according to health needs.

6.2.11 Tele Density

The total Tele Density in Pakistan, according to recent estimates in 2012, is more than 70%. This means that nearly 70% of the geographic area of Pakistan is covered by either mobile networks or landlines (106).The current mobile phone subscription has reached a land mark of nearly118 million at the beginning of 2012.

6.2.12 ICT language barrier

One challenge for Pakistan is the paucity of information available in the local national language. This language barrier also plays an important role from district to

district, even within one province. Although an important and recent development has been creation of a national language tool to write and edit font, the real challenge lies in translation of a huge body of evidence pertaining to every subject in a timely fashion.

6.2.13 Information Technology (IT) Infrastructure

The term *IT infrastructure* is defined as a combined set of hardware, software, networks, facilities, etc. (including all of the information technology), in order to develop, test, deliver, monitor, control or support IT services. Pakistan's IT sector infrastructure includes: Microwave radio relay, fiber-optic cable, cellular, and satellite networks. Specifically, submarine cable systems provide links to Asia, the Middle East, and Europe; and there are three Intelsat satellite earth stations (one over the Atlantic Ocean and two over the Indian Ocean), and three operational international gateway exchanges (two in Karachi and one at Islamabad) (108).

6.2.14 Human resources

To find trained and competent human resources in the IT sector remains a challenge in any organization. The wide spread of technology along with globalization has paved the way for a plain level field in terms of technology. Goodwin in 2003 identified five main components of economic growth in terms of capital investment (109). These are human, physical, natural, produced, and financial capital, with human capital remaining the most challenging form to find and retain. Table 6 summarises Stage 2 (PEST analysis) of the hypothetical application of the e-HSDF for Pakistan.

Table 6: Hypothetical application of the e-HSDF to Pakistan (Summary of Stage 2)

Stage 2 PEST Analysis			
Political	**Economic**	**Socio-Cultural**	**Technological**
1) No clear determination from federal government	1)Low income country	1) Low literacy rate	1) Tele density of nearly 70%
2) e-HAP expressed interest	2) Nearly 31% of population lives below poverty line	2)) Government spending on health in < than 01% of GDP	2) Largest tax payer sector
3) Political stability at present	3) Government spending on health in < than 01% of GDP	3) A country of nearly 180 million people	3) ICT language barrier
4) No legislation pertaining to e-health	4) Federal resource constraints (deficit budget of 1300 billion PKR (1$ US = 95 PKR)	4) Large geographical area	4) 118 million mobile subscribers as of March 2012
5) Law and order issues across country	5) Government aims to increase health spending to 1.5% by 2015	5) Cultural barriers for women in accessing health services	
6) An ally in “war on terror” with other forces			
7**)** 1.7 million Afghan refugees at present			

6.3 STAGE 3: Completion of the Matrix

At this stage a Matrix was completed in order to streamline the information that had been gathered at stage 2. A significant body of evidence was summarized to proceed into the next stage of health need prioritization. This information was collected during the evidence gathering exercise at Stage 1(section 6.1) and Stage 2 (section 6.2) of this research.

Table 7: Hypothetical application of the e-HSDF to Pakistan (Summary of Stage 3 – Matrix formation)

Stage 3 Matrix Formation							
Literature review				**PEST Analysis**			
National Health Policy	**Country Specific WHO Reports**	**National Health Reports**	**Published Articles**	**Political**	**Economic**	**Socio Cultural**	**Technological**
No clear policy directive	Vaccine preventable disease	Tuberculosis	Increase in childhood illnesses	No direction from federal government	Low income country	Low literacy rate	Tele density of nearly 70%
Telehealth an option	Difficulty in Polio vaccination	Cancers	Chronic disease burden increases	e-HAP expressed interest	Nearly 31% of population lives below poverty line	Government spending on health is < than 1% of GDP	Largest tax payer sector
Dissemination of research	Maternal mortality rate	Chronic diseases	Prevalence of tobacco smoking is on a rise	Political stability at present	Government spending on health in < than 1% of GDP	A country of nearly 180 million people	ICT language barrier
				No legislation pertaining to e-health	Federal resource constraints	Large geographical area	118 million mobile subscribers in March 2012
				Law and order issues across country	Increase health spending to 1.5% by 2015	Cultural barriers for women in accessing health services	
				An ally with NATO forces in "war on terror"		Inadequate infrastructure	
				Shelter to 1.7 million Afghan nationals			

6.4 STAGE 4: Health Needs Prioritization

Table 8 (a hypothetical performance sheet) can be used as a method to prioritize the health issues based on three important aspects in the context of Pakistan. These aspects are appropriateness, impact, and capacity. Appropriateness is further broken down into the particular issues of alliance with organizational, political and other stakeholder mandates. Impact is classified in terms of quantitative output. Capacity on the other hand is looked at from human, technological, and financial perspectives.

Table 8: Hypothetical application the e-HSDF to Pakistan (Summary of Stage 4 – Performance Sheet development)

Stage 4 Hypothetical 'Performance Sheet' for Pakistan									
Health issue	**Appropriateness**			**Impact**		**Capacity**			**Total 32**
	Fit with mandate	Fit with leadership	Fit with donor agencies	Number reached	Expected degree of change	Human skills available	Technological skills available	Financial cost	
Vaccine preventable disease	3	3	4	3	3	3	2	2	23
Chronic disease	3	3	2	2	2	3	2	1	18
Cancers	2	2	1	1	2	2	2	1	13

Scale: 4=Excellent, 3=Very Good, 2= Good, 1= Poor

It should be noted that this Performance Sheet is a hypothetical construct prepared without consulting resource personnel in Pakistan, and it is mainly for illustration of the Performance Sheet development process designed through this research. In any real application, a more formal Performance Sheet should be created with consultation of stakeholders in order to generate the correct priority health issues for any given country.

6.5 STAGE 5: e-Health Solutions

This stage is crucial. It deals with health priority issues on one end and possible e-health solutions on the other end. It must be remembered that not every health issue can be addressed by e-health solutions. Furthermore, not every e-health solution will be applicable in all parts of a country (based on issues such as remoteness, infrastructure, access and culture). These findings are described in Table 9 which is a hypothetical illustration of identifying appropriate e-health solutions based on health issues. This Table, if constructed properly, will lead to assessment and selection of the most viable e-health option(s) and will set the overall scenario for e-health application in the context of the health system of Pakistan for the future.

It should be noted once again, that Table 9 is a hypothetical application, made without consulting resource personnel in Pakistan and it is mainly for illustration of potential e-health solutions.

Table 9: Hypothetical application of the e-HSDF to Pakistan (Summary of Stage 5 – Potential e-Health Applications)

Stage 5 Hypothetical e-Health Applications for Pakistan				
Priority Health Needs	**Possible e-health Solutions**			
	Telehealth	**Health Informatics**	**e-Learning**	**e-Commerce**
Vaccine preventable illnesses				
Polio	m-Health for tracking doses	1) Child Identifier 2) Surveillance 3) Vaccination record	Promote importance of polio vaccine through electronic media in local language.	Inventory of doses
(Other priority health need)	e-Health option(s)	e-Health option(s)	e-Health option(s)	e-Health option(s)
Non Communicable Diseases				
Diabetes	Diabetes management through telehealth for outreach areas	Diabetes registry	1) Public education through electronic media 2) Health care provider education via CME's	Inventory of gluco-sticks and monitors at health centre
(Other priority health need)	e-Health option(s)	e-Health option(s)	e-Health option(s)	e-Health option(s)
Cancers				
Lung cancer	e-Consultation	1)Chemotherapy schedule 2)Cancer registry	Health information in local language	Cost of chemotheraphy at health centre
(Other priority health need)	e-Health option(s)	e-Health option(s)	e-Health option(s)	e-Health option(s)

6.6 STAGE 6: e-Health Strategy Document Development

By completing this exercise from Stage 1 to stage 5 (as outlined in the conceptual framework) an e-health strategy document will be created. This e-health strategy framework document will guide the implementers as to what could be done to address particular health issues using appropriate e-health solutions. This strategy document will be an evidence based tool based upon sound gathering of information before any resources need be committed or used.

Chapter 7: Discussion

The world is witnessing an ever increasing demand for health care. With a global population of nearly 7.08 Billion people (about 70 Million born just this year), and projected to be 8 Billion in 2025 and 9 Billion by 2045, the stress is greater than ever before in the history of mankind. Long life expectancy and increases in the burden of non-communicable diseases (including cancers) are the main factors in the developed world (2). Inability to control vaccine preventable illnesses, the HIV epidemic (particularly in African countries), the lack of services in rural areas, the lack of human resources, and population growth pose the greatest challenges for the resource constrained developing countries (4). Across the globe health care services consume a major share of available resources in an attempt to address the complex health issues.

At the same time as health demand has increased, the past 2-3 decades has seen "Information and Communication Technologies (ICTs)" achieve success in filling some of the unmet needs in health services in isolated settings under the name of 'e-health' (6). The term 'paradigm shift' is a notion that was widely used in the literature to depict the complete turnaround to new ICT facilitated models of care from previous ones. For example, the industrial revolution in the eighteenth century witnessed a paradigm shift from a society that was heavily reliant on humans to one that became heavily reliant on machines. e-Health can also be viewed as a paradigm shift away from traditional health care delivery systems, which rely heavily on human and capital resources at every point of direct care to facilitate its services. e-Health provides an opportunity to again use

technology (here ICTs) to work more effectively and efficiently in urban and remote areas.

In essence e-health has the capability to radically transform the way health care information, data, knowledge, learning elements, products, or services are utilized and transferred from one place to another (i.e. from a physical mode to a digital mode) completely changing the way the health care system works (12).

Despite its potential value and impact, as reported in the literature, e-health is still finding it difficult to achieve sustainable integration into existing health systems of countries. On cause is the lack of clear strategy (43). The World Health Organization in 2005 acknowledged the need of ICT in achieving Millennium goals (24) along with challenging its member states to create their own national e-health strategy for addressing their health issues (25). To be effective an e-health strategy has to be formulated based on a clear understanding of the health and other important determinants of health at the country or regional level. Furthermore, it should address challenges, needs, capacity, and resources available at a given time.

A preliminary review of the literature revealed relatively few e-health strategy documents across the globe. Those found were mainly presented as ‘road maps’ based on stated objectives without describing any needs-based justification in identifying those objectives (41). As of today, no clearly defined e-health strategy framework, or plan, is available globally.

The initial literature to discuss the need for and value of an e-Health Strategy Framework was in 2007 by Scott, however that was based on personal experience with no theoretical support and a lack of evidence-based tools for its implementation (51). In the year 2011, a ‘work book’ on e-health strategy published through the Commonwealth identified some core steps towards formulating an e-health strategy, but it lacked some important aspects of health determinants (43). This current year (2012) a publication from WHO and ITU further emphasized and summarized steps purporting to create an e-health strategy outline. but this document was heavily concentrated towards health informatics (44). Given this recent progress with respect to e-health strategy, the global importance of this research is very high.

In the absence of research specific to developing an e-health strategy framework, the main objective was to examine the process of developing and e-Health Strategy Development Framework, and to test it using Pakistan as a hypothetical context. This current research was conducted to improve insight into the strategy formulation process in the context of e-health. it is major contribution is through describing the identification of appropriate e-health resources to address pertinent health issues for a given geographic entity. Given the strategy building concept is still in its infancy in the e-health literature, this framework will add to the existing e-health strategy literature. It will be of value in convincing both researchers and strategy makers to use the framework and tailor its application according to their own specific situation and needs.

The need for strategy before architecture also stems from literature. A relevant example from the business sector points towards creation of ‘strategy’ before architecture for ‘information technology’. Prior work in creating a ‘strategy’ leads the way for using ‘architecture’ to determine the required e-health design, which in turns helps in understanding the specific ‘infrastructure’ needs. Collectively, these sequential steps ensure pertinent ‘e-health solutions’ are used to address specific ‘health issues’ (110).

Of note is that for stage 2 of the framework (Figure 6; gathering the evidence for other determinants by using PEST analysis (71)), there were other tools also available such PESTLE analysis (70) and STEEPLE analysis (111). STEEPLE analysis, for example, includes Social, Technological, Environmental, Economic, Political, Legal and Ethical domains. PEST analysis was selected mainly to simplify the matrix so that it can be used by applying a bottom up approach and have understandability for all stakeholders. Furthermore, many of the other domains were overlapping, and were covered in the final synthesis of information.

Studies in the context of other factors in developing countries have identified that culture and traditions play an important role in ICT adoption. Pakistan is a country of more than one civilization and culture. Using PEST analysis at stage 2 in the framework also helped in identifying those aspects of culturally important health determinants that were relevant to the strategy building exercise.

There are numerous factors that add to the difficulties for providing healthcare services in Pakistan. A few of them are remote hard to reach areas, limited access to existing healthcare services, shortage of basic medical services, no proper referral system, and a lack of qualified health personnell (59). These difficulties create an opportunity, opening doors to find alternate methods to improve health system efficiency, alternate methods such as e-health that could play an important role in offering appropriate solutions.

Re-distribution of limited resource remains a challenge in applying this framework to any country or region setting. This can be evident from section 6.4 while creating the table for e-health solutions with respect to health needs / issues. Table 7 can be used as an evidence based tool for country leadership that shows e-health solutions can provide an opportunity to readjust limited resources towards health promotion and prevention from curative services for the long term benefit of the population. For example, Pakistan is facing the double burden of diseases at present. Non-communicable diseases will need more resources to manage at any level of a health system. e-Health provides an opening to work towards health promotion strategies using e-health solutions that lead to a decrease in the incidence at population and individual levels early on and prior use of valuable resources in managing lifelong illnesses.

Actual implementation of e-health solutions identified through an e-health strategy, although not a mandate of this research, poses a great challenge if not addressed properly. Creation of an e-health task force at the federal government level would help to

steer this process in any country. This committee should be comprised of members from several sectors (government, academia, business, partner ministries [telecommunication, science and technology, as well as health]). Of concern in some countries (including recently Pakistan) is that the 'health' of a population may be a sub-national mandate. For Pakistan, having a mix of Provincial and Federal oversight, an 'e-health task force' at the Federal level may help in collaboration and attaining the support needed from multiple ministries. For example, if an e-health strategy is only developed at the provincial level then difficulties in implementation may arise with federally administered areas which must still align with the federal government.

Study Learning

While theoretically applying the framework to Pakistan, it was learnt from the proceedings of the past e-HAP Conferences (2011 and 2012) (111) that there is a critical mass of people working in academia, government, and the private sector who are 'ready' for technological solutions to address the long standing issues that pervade the health care delivery system. Similarly, a strong desire to move e-health forward was evident from the e-HAP presentations. Overall, e-HAP remains a positive force and source of support for e-health strategy development for Pakistan, and it may be possible for this recognized entity to present a case to the Government of Pakistan for structured and thoughtful e-health integration within the health system of the country (66).

Study Limitations

Although the study followed rigorous scientific methods there are certain limitations that need to be highlighted. This e-HSDF was created without interviewing resource personnel in Pakistan, and without having them on board for implementation. This is mainly due to the mandate for this research. Future research in this domain should ensure country or region specific representation is integral from the initial phase of framework development. This will develop ownership from the ground level, and pave the way for implementation.

Study Recommendations

This research leads to three recommendations:

1. Policy makers should use the e-HSDF to ensure wise investment in e-health.

   It is anticipated that this study will provide input to help in future implementation and use of e-health in any health care system.

   For Pakistan, arguably the biggest challenge will be in terms of financial and human resource capital. The e-HSDF will help Pakistan's policy-makers avoid any waste of resources in providing health care services to its citizen

2. Different Ministries within Government should work jointly under this common framework for better integration of e-health into health systems.

   The e-HSDF could form the basis of a common platform, within which different Ministries of a Government could interact with each other in order to make decisions that influence the health of an entire nation. The services of many departments (like education, information technology, health, commerce, and telecommunication) are required for holistic and successful implementation of e-health services, the e-HSDF could serve as a focal point where different Ministries could work in synergistic harmony.

3. The ICT industry should consider the final e-health strategy of a country, created by using the e-HSDF, to understand their potential role in future e-health programs and services of the country.

Current focus of vendors is on what they can do best, rather than on what is best for a country, Application of the e-HSDF could provide useful insight to vendors in the ICT industry, identifying where they should focus development of appropriate, and therefore valued, future e-health programs and services for a country.

Chapter 8: Conclusion

The current study and resulting strategy framework is an attempt to address health issues within health care systems using evidence based tools in the context of e-health. Given that developing countries have their own health problems and that resources (financial and infrastructure) are limited, looking for simple and economically affordable e-health solutions will be important for successful adoption and positive outcomes.

Every country or geographical entity has its own peculiar health issues and available resources in terms of technical, human, and financial terms. This exercise, if completed in accordance with the conceptual framework, will help in formulating a country specific e-health strategy. Without this exercise, in this era of technological advancement in the health sector, there will be chances for significant waste of limited resources.

The study has resulted in a better understanding of e-health strategy development in general and in particular to developing countries - especially Pakistan. Considering the transition to, and rapid growth of, e-health and potential use of e-health in developing countries, this study was a timely investigation and can serve a to guide future development of e-health strategies for countries.

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