

**United Nations Economic and Social Commission for Asia and the Pacific  
Information, Communication and Space Technology Division  
Research Group**

**Working Paper**

# **e-Health for a Leapfrogging Asia and Pacific: Challenges and Opportunities**

## **Executive Summary**

e-Health has been evolving rapidly around the world. Various e-health initiatives and policies have been put in place to address challenges of providing universal health care and improving the quality of health care services in a cost efficient manner. This paper aims to provide a broad overview of e-health development in Asia and the Pacific and what could be done to promote better health through e-health among developing countries. Based on the assessment, four characteristics on the e-health development in the region were identified and the concept of the *national health information infrastructure* which connects all the key stakeholders is proposed.

**Bangkok, Thailand  
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## **Disclaimer**

The key concept of this paper was initially developed for the Commission Session Document “Development of Health Systems in the Context of Enhancing Economic Growth Towards Achieving the Millennium Development Goals in Asia and the Pacific”. The concept was further elaborated and refined in this working paper by Ms. Atsuko Okuda and Mr. Jean-Michel Sadoul, with contribution by Mr. David Hastings, Mr. Cihat Basocak and Mr. Clovis Freire. The view and content of the document are of the authors and do not necessarily reflect the organization’s view.

This is a working document. The authors are planning to update the content to reflect new developments as well as views and perspectives wherever necessary. The most current version is available on the web at <http://www.unescap.org/icstd/research/papers/>. Please send your comments and suggestions to [okuda@un.org](mailto:okuda@un.org) and [sadoul@un.org](mailto:sadoul@un.org).

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## 1. Introduction

The importance of information, communication and space technology (ICST) in health has increasingly been recognized by government agencies, health practitioners, private sector, academia and NGOs across the world. Judging from current news, research and reports, ICST adoption by various players in the health sector has been accelerating as well as spreading geographically in the recent years. A number of e-health initiatives have sprung up from metropolitan areas to remote rural areas and, increasingly, in both developed and developing countries.

The emergence of e-health is accentuated by the need to address challenges in improving the health system. It is also considered as a response to the cross border nature of epidemics, such as HIV/AIDS, SARS and avian flu, increased recognition of regional and international aspects of health care provision and need for concerted and coordinated actions. Such need for concerted and coordinated actions at the regional level has been felt even more strongly in a disaster situation.

In this context, this paper aims to provide a broad overview of e-health development in Asia and the Pacific and what could be done to promote better health for all through e-health among developing countries. As e-health is an emerging issue especially in the context of developing countries in Asia and the Pacific, this study aims to identify key characteristics in the e-health development in the region. As a first attempt, the study intends to cover a wide range of issues which can be considered as a potential factor to shape the future of e-health as well as a constraint to such development.

This study considers the following elements to determine the overall level of e-health development in the region:

- Ongoing telemedicine and e-health initiatives in Asia and the Pacific to identify their common denominations and characteristics
- ICST and health policies and strategies as an indicator of level of development of an enabling environment
- e-Health industry in Asia and the Pacific as an engine to drive e-health
- e-Health on the agenda of sub-regional organizations as a regional framework for e-health development

These aspects of e-health development were selected based on an initial assumption that e-health in Asia and the Pacific has not been fully integrated in the ICST policies and strategies and therefore not benefiting from existing infrastructure, resources and expertise at the local, national and regional levels, while an overall perception among policy and decision makers is that e-health is expensive and competes with current health priorities of the country.

The collection of data and information was done mainly through web searches and content review of available documents. The study relies primarily on literature review of reports, studies and news articles which were published by the governments, private sector, inter-governmental bodies, media and academia. The authors consider this assessment especially timely when a number of reports and research have been published on the performance of telecenter/telehealth initiatives in developing countries, while new e-health technologies and policy frameworks reinvigorated discussions on the need of ICST for health.

Since the purpose of the study is not to produce a comprehensive list of initiatives or policies but to raise awareness among policy and decision makers, an omission of major initiatives may be pointed out. As a working paper, this study will evolve and take into account new development as well as a need for refinement of methodology, including adding new elements to the above to project a more accurate overview of e-health development in the region.

In the latter half of the document, this paper aims to

- identify key constraints and challenges in scaling up and rolling out nation-wide e-health initiatives in a sustainable manner and optimising e-health investments
- introduce the concept of the national health information infrastructure as a way forward and a solution to overcome the challenges
- identify key policy recommendations to support e-health development through the national health information infrastructure

Accordingly, this paper targets mainly at policy and decision makers and government officials in the area of health and ICST, healthcare providers, private sector and researchers.

## **2. Global Context**

Advances in ICST present great opportunities to improve access and quality of healthcare services: e-health technologies can, to a varying degree, empower countries, decision makers, researchers, healthcare institutions/professionals, and users of such systems. ICST helps enhance geographical reach, accuracy and timeliness in the provision of health information and services. It can improve management and network efficiency and effectiveness among health related knowledge developers, providers and government. It offers tools to continuously update skills and knowledge of professionals and the general public. With the technology, health professionals would be able to make evidence-based decisions, while policy and decision makers monitor and assess outbreak, spread and control of epidemics at the local, national and regional levels. e-Health offers a means to cope with an increasing demand on healthcare services and helps shape the future of health care delivery, making it more citizen-centered. e-Health can also help to contain costs through gained efficiencies and effectiveness.

Heads of State and decision makers acknowledged the potential benefits of ICST in improving the healthcare system, by including e-health in the Geneva Plan of Action<sup>1</sup> of the World Summit on Information Society (WSIS) in 2003. Action Line 7 promotes the adoption of e-health, including medical training and research through the use of ICST, the development of international standards for the exchange of health data and the creation of a reliable, timely, high quality and affordable healthcare and health information systems. A stated goal is to connect health centres and hospitals with ICST by 2015. The WSIS Plan of Action also urges the use of ICST to achieve the Millennium Development Goals (MDGs) and other internationally agreed development goals. Among the eight MDGs, health concerns three goals: MDG 4 (reduce child mortality), 5 (improve maternal health) and 6 (combat HIV/AIDS, malaria and other diseases). Thus, the integration of ICST in health is positioned as a strategic means in achieving MDGs and, consequently, poverty reduction.

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<sup>1</sup> Plan of Action, World Summit on the Information Society at <http://www.itu.int/wsis/docs/geneva/official/poa.html#c7-18>

The importance of e-health was further confirmed by the fact that in May 2005 the World Health Assembly of the World Health Organization (WHO) endorsed a resolution on e-health<sup>2</sup> that invites all member states to develop their own national e-health strategies and accordingly established the Global Observatory for e-health<sup>3</sup>. The International Telecommunication Union (ITU) established ITU-T Study Group 16 Work on e-Health to handle the standardization of multimedia systems to support e-health applications<sup>4</sup>.

At the regional and national levels, a number of new initiatives and policies were formulated and being implemented in industrialized and developing countries alike. In Europe, the EU e-health portal was launched in 2006 and member States have formulated respective e-health strategies<sup>5</sup>. The EU e-health Action Plan was published in 2004 with the aim to create the national e-health infrastructure, electronic health records and patient summaries, while ensuring their interoperability. In April 2007, EU member States, Iceland, Liechtenstein and Norway have adopted a common declaration on cross border electronic health services across Europe which enables access to patient medical records and patient summaries from anywhere within Europe<sup>6</sup>.

In the US, the National Health Information Incentive Act of 2007 established the permanent position of national coordinator for health information technology, while it is expected that the Health Information Technology Act of 2007 would lead to the allocation of USD 4 billion in grants over 5 years to facilitate the adoption of interoperable information technology<sup>7</sup>. Accenture and Oracle are developing a prototype for secure information sharing among healthcare communities within the framework of the Nationwide Health Information Network (NHIN)<sup>8</sup>.

### 3. Definitions of various ICT and health related terminologies

The terms e-health and telemedicine are usually used interchangeably. However, e-health is a broader term that includes telemedicine and other forms of use of ICST for health. The relation between e-health and telemedicine is similar to the relation between health systems and medicine. While telemedicine is a term to describe the provision of clinical care through ICST, e-health may refer to clinical and non-clinical services that use ICST, including administration, research, training, and provision of medical services through the use of Internet, short message service (SMS), or other related technologies. Some well accepted definitions are:

**e-Health** - Use of ICST to meet needs of citizens, patients, healthcare professionals, healthcare providers, as well as policy makers. In a broader sense, the term has been used to characterize a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using ICST<sup>9</sup>. The Health Information and

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<sup>2</sup> World Health Assembly resolution, EB115.R20 on e-health in 2005 at [http://www.who.int/entity/healthacademy/media/en/e-health\\_EB\\_Res-en.pdf](http://www.who.int/entity/healthacademy/media/en/e-health_EB_Res-en.pdf)

<sup>3</sup> WHO Global Observatory for e-health (GOe) at <http://www.who.int/kms/initiatives/e-health/en/>

<sup>4</sup> ITU-T Study Group 16 Work on e-Health at <http://www.itu.int/ITU-T/studygroups/com16/e-health/index.html>

<sup>5</sup> Communication from the Commission to the European parliament, the Council and the European Economic and Social Committee and the Committee of the Regions, i2010 – Annual Information Society Report 2007, Commission of the European Communities, March 2007 at [http://ec.europa.eu/information\\_society/eeurope/i2010/docs/annual\\_report/2007/070329\\_com\\_en.pdf](http://ec.europa.eu/information_society/eeurope/i2010/docs/annual_report/2007/070329_com_en.pdf)

<sup>6</sup> "Electronic health services without borders", CORDIS News April 2007 at <http://www.e-healthnews.eu/content/view/526/27/>

<sup>7</sup> "Senators to Introduce I.T. Bill, Health Data Management", Health Data Management, 21 May 2007 at <http://healthdatamanagement.com/html/news/NewsStory.cfm?articleId=15162>

<sup>8</sup> "Oracle participates in developing Accenture Nationwide Health Information Network Prototype" ThomasNet Industrial News at <http://news.thomasnet.com/companystory/506424>

<sup>9</sup> Gunther Eysenbach, "What is e-health?", Journal of Medical Internet Research, 2001 at <http://www.jmir.org/2001/2/e20/>

Management Systems Society (HIMSS) defines e-Health as “the application of Internet and other related technologies in the healthcare industry to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by healthcare organizations, practitioners, patients, and consumers in an effort to improve the health status of patients”<sup>10</sup>.

**Telemedicine** – the practice of medical care using audio, visual and data communications; this includes medical care delivery, consultation, diagnosis, treatment, education and the transfer of medical data<sup>11</sup>

**Tele-health** - an expansion of the functionality of telemedicine. Unlike telemedicine (which focuses on the curative aspect) it also encompasses preventive, promotion and curative aspects. Originally used to describe administrative or educational functions related to telemedicine; today the emphasis is on practicing tele-health and not telemedicine<sup>12</sup>.

This paper focuses primarily on e-health as an emerging trend and new paradigm for providing better, more efficient and effective healthcare services. The following section describes why e-health is an emerging topic, followed by analysis on limitations and challenges posed by telemedicine and tele-health initiatives.

## 4. General Overview of e-health

### 4.1 Current ICST usage in health

There are some interesting data and figures which indicate the current usage of ICST in health. These applications were intended for medical, clinical, administrative and managerial functions within the health system. The uses of ICST for health systems include tools for health authorities and professionals as well as personalized health systems for patients and citizens (Table 1).

<b>TECHNOLOGY</b>	<b>DEVICES and SOFTWARE</b>	<b>APPLICATIONS</b>
Diagnostics	Stethoscope EKG X-ray/CatScan & medical image analysis software	Consultations Telehomecare
Videoconferencing	Cameras ( <i>e.g. videocams, webcams</i> ) Computer-based desktops Portable communications & data systems	Consultations Tele dermatology Tele mental health
Digital imaging	Instruments Media ( <i>e.g. film, magnetic tape</i> ) Scanners/Viewers Digital cameras Videocams with scopes	Telepathology Teleradiology Teledentistry Tele dermatology
IT	Data storage systems	Electronic medical

<sup>10</sup> HIMSS “HIMSS e-health SIG White Paper” at [http://www.himss.org/content/files/e-health\\_whitepaper.pdf](http://www.himss.org/content/files/e-health_whitepaper.pdf) 2003

<sup>11</sup> Salah H. Mandil “Tele-health: what is it? Will it promote cross-border trade in health services,” in the publication “International trade in health services: a development perspective” 1998

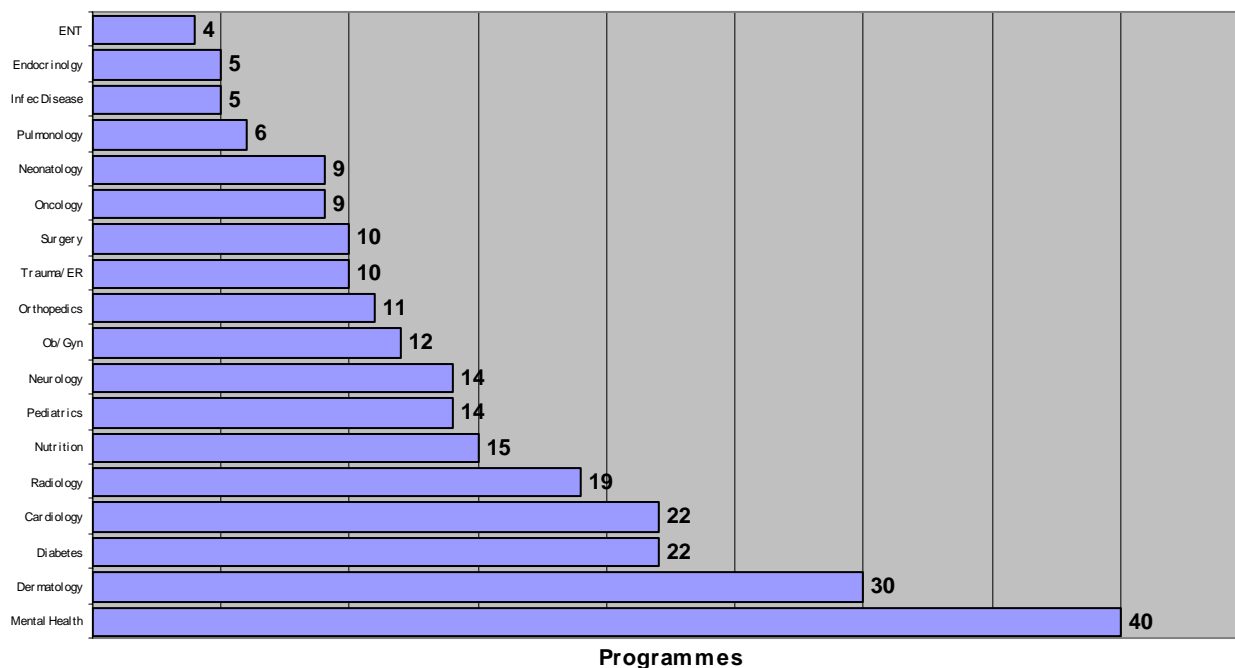
<sup>12</sup> “Tele-health” Wikipedia at <http://en.wikipedia.org/wiki/Tele-health>

	Servers Software/Informatics - DBMS/GIS <sup>13</sup> Middleware	records Data mining Web portals Decision-support systems Administration
Store-and-Forward	Data/image/video/audio card capture/scanners Computer/camera/microphone & image management software	Electronic medical record Report generator
Simulation & Training	Multi-media graphics Software Audio-visual	e-Learning Curriculum Conferencing

Source: "Innovation, Demand and Investment in Tele-health"<sup>14</sup>

In terms of telemedicine specific applications, the highest usage was reported in the area of mental health, followed by dermatology, diabetics, cardiology, radiology and nutrition (Chart 1).

**Chart 1. Telemedicine Applications in US in 2002**



Source: Tele-health Overview: global health Technology Summit, US Department of Health and Human Services, 2006

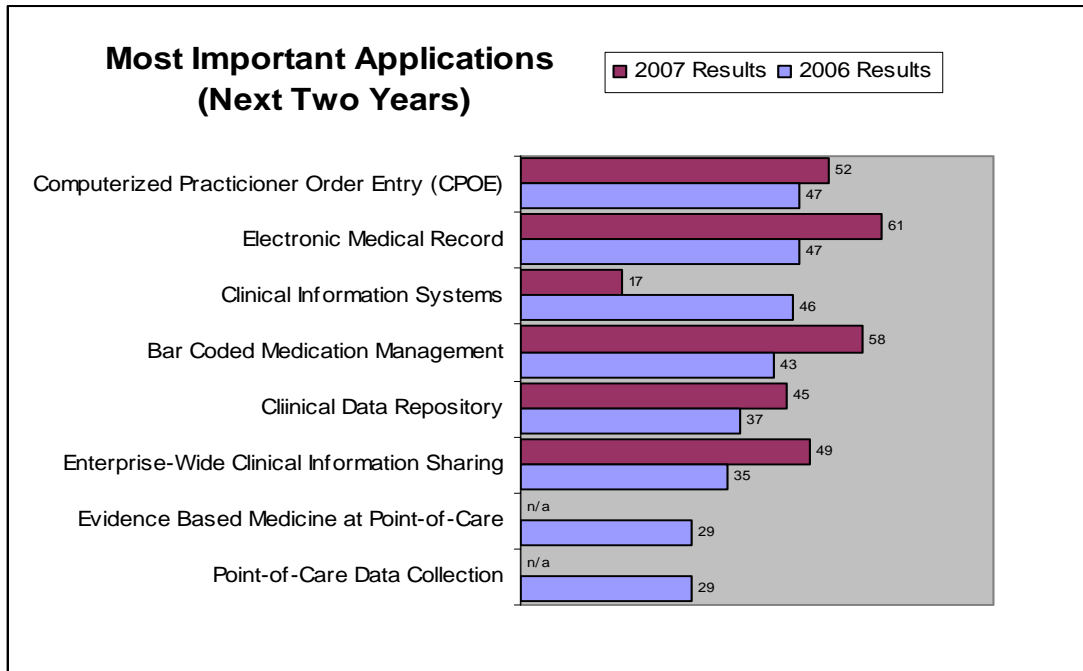
The 2007 Healthcare Information and Management Systems Society (HIMSS) Leadership Survey revealed that the most important applications identified by chief information officers (CIO) in the health sector include computerised practitioner order entry, electronic medical record and clinical information systems (Chart 2)<sup>15</sup>.

**Chart 2.**

<sup>13</sup> DBMS = Data Base Management Systems / GIS = Geographical Information Systems – both adapted for health applications

<sup>14</sup> David Brantley, Karen Laney-Cummings and Richard Spivack "Innovation, Demand and Investment in Tele-health" February 2004 at <http://www.technology.gov/reports/TechPolicy/Tele-health/2004Report.pdf>

<sup>15</sup> "2007 HIMSS Leadership Survey" April 2007 at <http://www.himss.org/2007Survey/DOCS/18thAnnualLeadershipSurvey.pdf>

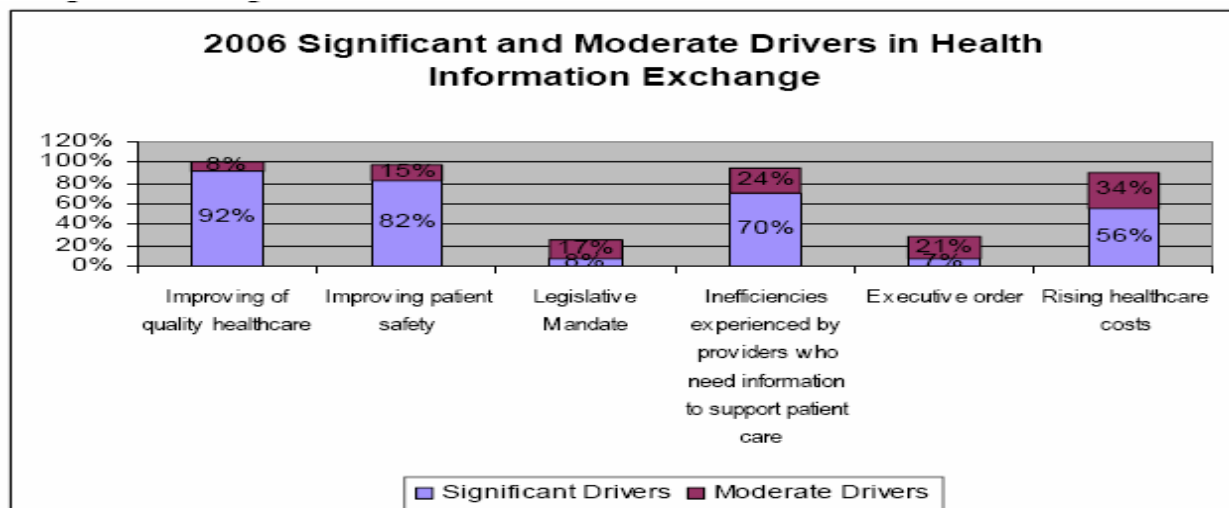


Source: 2007 Healthcare Information and Management Systems Society (HIMSS) Leadership Survey

#### 4.2 The rationale behind the increasing use of ICST in health

The use of ICST in health has increasingly been seen as a solution to address challenges of having less available resources and meeting the expectations for improved quality of health care services<sup>16</sup>. A recent survey<sup>17</sup> confirms this, showing that factors driving the introduction of e-health are to improve the quality of healthcare, patient safety, limiting the inefficiencies experienced by providers who need information to support patient care, and tackling rising healthcare costs (Chart 3).

Chart 3.



<sup>16</sup> Salah H. Mandil, "Tele-health: what is it? Will it propel cross border trade in health services?" in the publication "International trade in health services: a development perspective", 1998

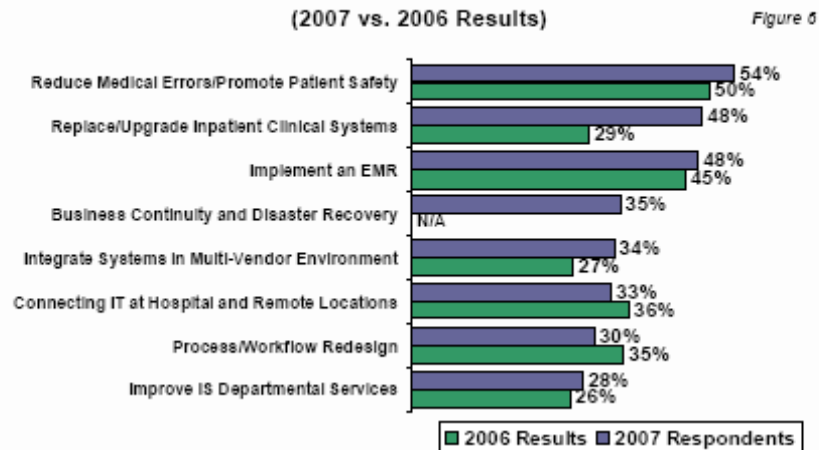
<sup>17</sup> "Improving the quality of healthcare through health information exchange: selected findings from e-health initiative's third annual survey of health information exchange activities at the state, regional and local levels", September 2006 at <http://toolkits.e-healthinitiative.org/assets/Documents/eHI2006HIESurveyReportFinal09.25.06.pdf>

Source: "Improving the quality of healthcare through health information exchange", Sept 2006

The above mentioned HIMSS Leadership Survey concluded that the top priorities in implementing technology for CIOs in the health sector within the next 12 months were identified to reduce medical errors and promote patient safety (Chart 4).

Chart 4.

### Current IT Priorities (Within Next 12 Months)



Source: 2007 Healthcare Information and Management Systems Society (HIMSS) Leadership Survey

In terms of the cost saving, one study concluded that electronic prescribing alone could save at least \$29 billion a year in the United States, since it will help eliminate duplications of prescriptions and errors as well as identify less expensive generic drugs<sup>18</sup>. In Canada, the introduction of the Shared Diagnostic Imaging Systems was reported to have improved 20% in radiologist productivity and saved an estimated \$370 million annually<sup>19</sup>. Another report published by the Australian Centre for Health Research estimates that improved knowledge sharing, along with care plan management, would save more than AUD1.5 billion (USD 1.3 billion<sup>20</sup>) per annum and increased workforce participation and productivity could add another AUD 4 billion (USD 3.5 billion) to the economy per year<sup>21</sup>. The same report adds that more proactive disease management, knowledge utilization, care-coordination and remote monitoring of a patient medical condition would lead to significant improvements of health outcomes. Home monitoring of a person with chronic disease is expected to reduce emergency hospital visit by up to 40% and hospital admission by 30-60% while shortening the length of hospital stay by up to 60%.

Although there is no comprehensive assessment which determines the level of impact of e-health on health outcomes<sup>22</sup>, some studies have identified areas where e-health has contributed to enhancing cost-efficiency and outcomes. One study listed cases where telephone and mobile technologies improved healthcare delivery, such as adherence to medication, more targeted

<sup>18</sup> J. Tanne, "Electronic prescribing could save at least \$29 bn", British Medical Journal, 328, 15 May 2004

<sup>19</sup> R. Alvares, "Canadian Experience with Health Information Technology", presentation made on 14 May 2004

<sup>20</sup> USD 1 = AUD .1.13 as of 18 July 2007

<sup>21</sup> Michael Georgeff "E-health and the Transformation of Healthcare" April 2007 at

<http://www.achr.com.au/pdfs/e-health%20and%20the%20transofrmation%20of%20healthcare.pdf>

<sup>22</sup> P. Whitten, F. Mair, A. Haycox, C. May, T. Williamas and S. Hellmich, "Systematic review of cost effectiveness studies of telemedicine interventions", British Medical Journal, 2002: 324; 1434-1437

consultations and patient monitoring<sup>23</sup>. Other areas where e-health impacts were evidenced include teleradiology, teleneurosurgery, telepsychiatry, transmission of echocardiographic images, e-mail and video conferencing consultations<sup>24</sup>. In Pakistan, one study evaluated the role of telemedicine in a follow-up treatment of trauma patients of the earthquake of 2005 and concluded that significant reduction in readmission to tertiary care hospitals and reduced workload at main trauma care centres were observed<sup>25</sup>. Another study indicated that information systems in Germany, New Zealand and the UK were found to enhance the ability of physicians to identify and monitor patients with chronic diseases with access<sup>26</sup>.

While these figures and findings are not fully conclusive on what the cost saving and impact of e-health in a developing country would be, since there is no data nor comprehensive research on e-health usage in developing countries, these are promising indications. Thus, it is worthwhile to examine ongoing initiatives and policy frameworks and assess the current status of ICST and health among developing countries in Asia and the Pacific, followed by an assessment of what could be done to improve the health system with ICST.

## **5. Overview of e-health in Asia and the Pacific**

### **5.1 Projects and initiatives at the national level**

Most countries in the Asian and Pacific region have experimented with some e-health and/or telemedicine initiatives, driven by the government, private sector and civil society. While some of these initiatives have just been pilot projects, others are now in full use at various levels. e-health/telemedicine initiatives in the region can be categorized roughly into the following clusters according to their main focus, although some have multiple functions and purposes:

- a) Development of infrastructure, networks and standards
- b) Electronic healthcare management,
- c) Telemedicine/tele-health
- d) Integrated health systems

Below is the list of some examples and cases:

#### ***a) Development of infrastructure, networks and standards***

Several countries in the region have been developing infrastructure such as connectivity, both within a facility (internal connectivity) and to other national or international sites (external connectivity), information standards and systems. The Philippine Council for Health Research

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<sup>23</sup> W. Kaplan, "Can the ubiquitous power of mobile phones be used to improve health outcomes in developing countries?", *BioMed Central*, 2006.2;9

<sup>24</sup> R. Roine, A. Ohimaa and D. Hailey, "Assessing telemedicine: a systematic review of the literature", *Canadian Medical Association Journal*, 2001: 165 (6)

<sup>25</sup> M. Faisal Murad, Riaz Ahmad, Salman Naeem, Qasim Ali, Aisha Ehsan, Tariq Sohail, Asif Zafar Malik, "Follow-Up of Earthquake Victims in a Remote Hospital Using Telemedicine" presented during the APT Regional Workshop on Telemedicine, February 2007

<sup>26</sup> Karen Davis, Cathy Schoen, Stephan C. Schoenbaum, Michelle Mr. Doty, Alyss L. Holmgren, Jennifer L. Kriss and Katherine K. Shea, "Mirror, Mirror on the Wall: an international update on the comparative performance of American health care", May 2007 at [http://www.commonwealthfund.org/publications/publications\\_show.htm?doc\\_id=482678](http://www.commonwealthfund.org/publications/publications_show.htm?doc_id=482678)

and Development and the Department of Health created one stop shop on health information in the country called “e-health Philippines”<sup>27</sup>.

To provide telemedicine services in India, 185 hospitals, 151 remote/rural/district level hospitals and 34 super speciality hospitals have been connected to a health network, with the support of local governments, the Indian Space Research Organisation (ISRO) and the Ministry of Information Technology. More than 150,000 patients have been provided with teleconsultation and treatment on the network<sup>28</sup>. These teleconsultations and treatments include both public and private initiatives.

### ***b) Electronic healthcare management***

Many institutions and, to a lesser extent countries, are computerizing their information systems including patient records, case management, inventory control and finances. Ultimately, such systems contribute to improved patient services, cost savings, and the development of public health early warnings<sup>29</sup>. Fiji is investing in telemedicine, long distance health education, awareness-raising and long distance health administration in order to solve the problem of physical and professional isolation of health personnel in the Fiji islands. As part of the Fiji Health Management Reform Project, the Government of Fiji developed the PATient Information System (PATIS)<sup>30</sup> to register each patient being treated in Fiji and keep a permanent record of their treatment. A National Health Card, with a unique National Health Number, is delivered to the patient at the end of the registration process. The system has been in implementation since 2001.

### ***c) Telemedicine/tele-health***

Though telemedicine has potential global reach, most current telemedicine networks are national or sub-national at the moment. Operation Village Health is a NGO-run telemedicine program in Cambodia. Two monthly telemedicine clinics, held in two remote villages of Cambodia, Rovieng and Banlung, give patients access to physicians at the Massachusetts General Hospital, Brigham and Women’s Hospital, and Partners/Dana Farber Cancer Care in Boston, United States. As part of the initiative, a nurse from Phnom Penh visits each of the villages and interviews, examines and digitally photographs patients, then transmits the information by satellite to physicians in Boston using a solar-powered computer. It is reported that within hours these physicians respond with medical opinions and treatment recommendations. Since the inception of these telemedicine clinics in 2001 up to early 2007, over 800 clinical consultations have been performed.<sup>31</sup>

### ***d) Integrated Health System***

In India, the Department of Information Technology, with the support of Apollo Health Street Limited, initiated a project to define the Framework for Information Technology Infrastructure

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<sup>27</sup> E-health Philippines at <http://www.e-health.ph/>

<sup>28</sup> Satyamurthy LS and Murthy RLN “Indian Telemedicine Programme – Efforts Towards Integrating the Stakeholders for Realizing a Technology Based Healthcare Delivery System”, Report prepared for the APT Regional Workshop on Telemedicine, February 2007

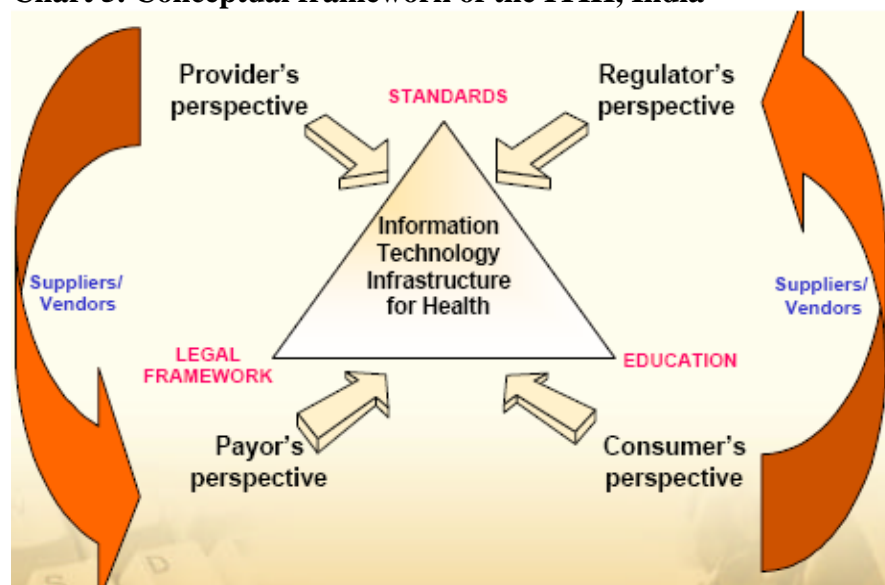
<sup>29</sup> They also help prevent mis-diagnosis or treatment (such as the administration of medication to which a patient is allergic) and even prevent mistaken identity

<sup>30</sup> Official website of Ministry of Health - Fiji, Patient Information System (PATIS) Overview at <http://www.health.gov.fj/patisOverview.htm>

<sup>31</sup> “Operation Village Health”, Center for ConnectedHealth at <http://www.connected-health.org/ConnectedHealthTest/Initiative.aspx?PageID=147>

for Health (ITI<sup>32</sup>). ITIH is defined as “a set of standards, guidelines and laws that help simplify transactions between various healthcare entities” with the aim of establishing an integrated delivery network in the country (Chart 5).

**Chart 5. Conceptual framework of the ITIH, India**



Source: Framework for Information Technology Infrastructure

In the project, major stakeholders were identified as public health agencies, health professionals and institutions, insurance companies, healthcare organizations, policy makers and consumers, with the thrust areas of the health information standards, legal framework and education framework for health in India.

Led by the academia, the Philippines National Health Information Infrastructure (PNHII) is a similar initiative with four major components: 1) capacity building; 2) standards and interoperability; 3) connectivity and 4) testbeds. Under PNHII, various initiatives, such as BuddyWorks Tele-health project, Integrated Local Health Information System, have been implemented<sup>33</sup>. It seems that an increasing number of countries are moving towards the development of integrated health systems.

## 5.2 Health in ICST policies and strategies in Asia and the Pacific

e-Health and telemedicine are technology-intensive initiatives. To ensure optimal and sustainable investment in the area, health should be positioned as one of the key social sectors in the national ICST policy and ICST in the national health policy. With a view to assessing the level of synergies between ICST and health, this study conducted preliminary analysis on 25 drafts and approved ICST policies and strategies as well as 6 ICST related policies and programmes in 24 member states in Asia and the Pacific.<sup>34</sup> 32% of the ICST policies, strategies and initiatives (10 out of 31) have no mention to health, while 68% (21 out of 31) have components related to e-

<sup>32</sup> Department of Information Technology, Ministry of Communication and Information Technology, India, “Final Recommendation; Framework for Information Technology Infrastructure for Health in India” at <http://www.mit.gov.in/telemedicine/index.pdf>

<sup>33</sup> Alvin Marcelo “Tele-health Initiatives in the Philippines: country Report”, e-health, report prepared for the APT Regional Workshop on Telemedicine, February 2007

<sup>34</sup> Afghanistan, Armenia, Azerbaijan, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Iran, Kyrgyzstan, Malaysia, Maldives, Mongolia, Nepal, Pakistan, Philippines, Republic of Korea, Samoa, Singapore, Sri Lanka, Thailand, Uzbekistan and VietNam

health or telemedicine. However, it is not only ICST policies and strategies that address and promote e-health: some member States have articulated visions, objectives and activities of how to use ICST in the health sector in other forms, such as the national five year plan (China)<sup>35</sup> and science and technology master plan (Maldives)<sup>36</sup>. In terms of how health is addressed in the above mentioned ICT policies and strategies, the objectives and approaches vary from country to country, with selected examples in Table 2.

Main Focus	Country	Activities
Basic Health	Thailand <sup>37</sup>	Develop IT systems in order to ensure quality, equal and thorough coverage, providing information on basic public health and ensuring the health and well-being of the people
R&D	Philippines <sup>38</sup>	Aim greater interaction within the country's S&T community including the Health R&D Information Network (HERDIN)
Enhanced service delivery	Philippines	Develop and implement information systems for government front-line services, such as health
	Indonesia <sup>39</sup>	Develop online public services including telemedicine and health data centres
	Afghanistan <sup>40</sup>	Provide health services virtually by specialist at a distance using e-medicine techniques
Integrated health system	Malaysia <sup>41</sup>	Transform the Malaysian healthcare system to be more integrated, distributed and virtual through lifetime time health record, MyHEALTH portal, Continuing Professional Development and Teleconsultation
	Mongolia <sup>42</sup>	Harmonize health sector and transport into patient centered, inexpensive, reliable worry free service anywhere and anytime with the establishment of the integrated electronic database system of medical records, applying ICT as tool to improve public health education and utilization of the distance treatment, diagnostic, monitoring as a new tool in rural areas
	Bangladesh <sup>43</sup>	Deliver new capabilities for hospitals and healthcare providers through electronic medical records, telemedicine, medical and health education as well as development of Bangladesh Health Portal and networked medical centre of excellence
	Bhutan <sup>44</sup>	Harness ICTs to enhance the quality and accessibility of health services through the establishment of links with neighbouring countries and international agencies to track emerging health threats, real time telemedicine and integrated health management system

One of the most progressive documents in terms of the depth and scope of coverage on ICST in health is Uzbekistan's National Integrated Information Healthcare System concept draft issued by the Ministry of Health<sup>45</sup>. It proposes the establishment of open standards, integrated platform, external healthcare provisioning applications and systems, among others.

<sup>35</sup> China: Summary of the 10<sup>th</sup> Five Year Plan, 2001-2005 at <http://www.trp.hku.hk/infofile/china/2002/10-5-yr-plan.pdf>

<sup>36</sup> Ministry of Communication, Science and Technology, "Maldives Science and Technology Master Plan" at <http://www.mcst.gov.mv/Documents/mplan.htm>

<sup>37</sup> IT Policy Framework 2001-2010: Thailand Vision Towards a Knowledge-Based Economy, 2003

<sup>38</sup> National Information Technology Council, Philippines, "IT 21: Philippines Asia's Knowledge Hub", 1997 at <http://www.neda.gov.ph/Subweb/IT21/it21.pdf>

<sup>39</sup> Five Year Action Plan for the Development and Implementation of ICT in Indonesia, 2001

<sup>40</sup> Ministry of Communications, Afghanistan, "Draft ICT Policy Paper" at

[http://www.export.gov/afghanistan/pdf/ict\\_policypaper.pdf](http://www.export.gov/afghanistan/pdf/ict_policypaper.pdf)

<sup>41</sup> Multimedia Development Corporation, "Malaysia Multimedia SuperCorridor: tele-health" at

<http://www.msc.com.my/msc/tele-health.asp>

<sup>42</sup> Information and Communication Technology Agency, Mongolia, E-Mongolia National Program, 2006

<sup>43</sup> Bangladesh National ICT Policy, 2002 at <http://www.bangladeshgateway.org/npict.php>

<sup>44</sup> Royal Government of Bhutan, "Bhutan ICT Policy and Strategy", 2004 at

<http://www.dit.gov.bt/guidelines/BIPS%20Final%20Report%20-%20v5.1.pdf>

<sup>45</sup> Ministry of Health of the Republic of Uzbekistan, "National Integrated Health Information System of the Republic of Uzbekistan concept draft" at <http://en.ictp.uz/downloads/concept.pdf>

It should also be noted that the fact that health is not reflected in an ICST policy alone does not lead to a disconnect between ICST and health. ICST could well be reflected in a health policy as an enabler. For instance, India included telemedicine and national disease surveillance network in their National Health Policy<sup>46</sup> as well as the above mentioned framework document for IT for health infrastructure. India formed a National Task force on telemedicine under the Ministry of Health in 2005<sup>47</sup>.

However, in order to create sustainable linkage between health and ICST sectors and ensure that ICST needs of the health sector are addressed in the ICST development in the country, it is imperative that a clear vision, objective and activities on how to integrate ICST to promote health are articulated within a national ICST policy.

### 5.3 Emerging e-health industry in the region

In addition to being a solution provider to multiple health challenges and an enabler of social development, the e-health industry can play another role, as a potential growth and export industry and an enabler of economic development. In order to harness ICST for health, it is imperative to develop an e-health industry which can deliver and support training, services, devices and appliances at the local level. e-health requires a mix of IT and medical expertise<sup>48</sup>, and local knowledge (e.g. for localization of terminology)<sup>49</sup>. Increasing e-health initiatives present a need as well as potential for the growth of the national and regional e-health industry.

The e-health industry encompasses the following categories:

- Medical content and applications, such as medical information systems
- Services, such as telemedicine and tele-health
- Medical appliances and devices

Increasingly, the e-health industry has been recognized not only as a solution provider to overcome health challenges but also as an industry with a powerful growth potential. Analysts see healthcare IT and e-health being a market in full expansion, and a great opportunity for countries to develop high-value knowledge workers and industries. Just to illustrate the point, there are some estimates to indicate the significant size of the market:

- The world medical-healthcare market size is estimated to be US \$740 billion in 2007<sup>50</sup>
- In the USA alone, the overall health care IT market is expected to reach \$38 billion in 2009<sup>51</sup>.
- The health care IT market has annual double-digit increase in size and is forecasted to reach by 2011 almost twice the size it was in 2005<sup>52</sup>.

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<sup>46</sup> "National Health Policy 2002 India" at <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN009630.pdf>

<sup>47</sup> SatyamurthyLS and Murthy RLN "Indian Telemedicine Programme – Efforts Towards Integrating the Stakeholders for Realizing a Technology Based Healthcare Delivery System", Report prepared for the APT Regional Workshop on Telemedicine, February 2007

<sup>48</sup> "Health Industry Searches for Next Informaticians" Eweek at <http://www.eweek.com/article2/0,1895,1665494,00.asp>

<sup>49</sup> Michio Kimura, Yun Sik Kwak, "Global Vocabulary vs. Local Healthcare Cultures" a paper prepared for the Asia Pacific Association of Medical Informatics (APAMI) meeting "Towards Global Interoperability for Electronic Health Records" in 2006 at <http://www.apami.org/apami2006/program.htm#10273>

<sup>50</sup> Kyoung-yong Jee and Dong-Sup Oh "APT Study Groups Meeting - Case Study" April 2005 at [http://www.aptsec.org/meetings/2005/sg25/DOCS/25SG-05-SG4-SQ4.10\\_ETRI-Korea.doc](http://www.aptsec.org/meetings/2005/sg25/DOCS/25SG-05-SG4-SQ4.10_ETRI-Korea.doc)

<sup>51</sup> "Health Care IT Market Looks Fit" CIO Insight, October 2005 at <http://www.cioinsight.com/article2/0,1540,1879790,00.asp>

<sup>52</sup> "Report: Health IT Market to Double by 2011" eWeek, 7 September 2006 at <http://www.eweek.com/article2/0,1895,2013497,00.asp>

- U.S. health care organizations spent \$19.1 billion on IT in 2006 and will spend \$20.4 billion this year. By 2010, that number will increase by nearly 25 percent to \$25.5 billion<sup>53</sup>
- By 2010, e-health spending may account for up to 5% of the total health budget of the 25 EU member States<sup>54</sup>
- The health IT industry is one of New Zealand's best performing high-tech export sectors<sup>55</sup>. Its health IT exports in 2006 were estimated at NZ \$227 million (USD 183 million)<sup>56</sup>.

The European Commission considers e-health as one of the emerging sectors and is working on ensuring e-health interoperability and creating an innovation-friendly e-health market in the area of personal health monitoring and management. The Commission also aims to establish health information networks based on broadband, mobile and grid technologies<sup>57</sup>.

An increasing number of decision and policy makers in Asia and the Pacific have started actively promoting the introduction of e-health and development of the e-health industry. The Republic of Korea, for instance, identified e-health as one of its “next generation growth industry” and the government is taking measures in order to become one of the key players in the e-health industry by 2013<sup>58</sup>. However, there still is space for the region's IT Health industry to grow. On the Annual Healthcare Informatics 100 List, which ranks the top 100 companies by healthcare IT revenues in the USA, only one company, Sentient Health from Singapore, is listed from Asia and the Pacific<sup>59</sup>. Collectively, these 100 companies sold over \$20 billion in IT products in 2005.

#### **5.4 Regional and subregional initiatives and activities**

There are already regional and sub-regional initiatives which promote the use of ICST in health. Since the outbreaks of Severe Acute Respiratory Syndrome (SARS) and Avian flu, geoinformatics has been recognized by WHO, the Food and Agriculture Organization (FAO) and some countries as powerful tools supporting effective preparation and planning for control of these and other possible pandemics. WHO, for instance, uses the website to connect the Global Outbreak Alert and Response Network (GOARN)<sup>60</sup> which monitors the outbreaks of avian flu and other infectious diseases.

The Asia and Pacific Economic Cooperation (APEC) has proposed the establishment of the Asia Pacific Information Infrastructure (APII) which will connect research and experimental networks in the region. It is expected that with these facilities, the development of and experiments for

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<sup>53</sup> “Healthcare gets better IT prescription”, Baseline, 24 May 2007 at <http://www.baselinemag.com/article2/0,1540,2136101,00.asp>

<sup>54</sup> Commission of the European Communities, “e-Health –making healthcare better for European citizens: an action plan for a European e-Health area” e-health2003 at [http://ec.europa.eu/information\\_society/doc/qualif/health/COM\\_2004\\_0356\\_F\\_EN\\_ACTE.pdf](http://ec.europa.eu/information_society/doc/qualif/health/COM_2004_0356_F_EN_ACTE.pdf)

<sup>55</sup> “Health IT industry profile”, MarketNewZealand.com at <http://www.marketnewzealand.com/MNZ/aboutNZ/sectors/14379/15913.aspx>

<sup>56</sup> 1 USD = USD 1.24 as of 17 July 2007

<sup>57</sup> Communication from the Commission to the European parliament, the Council and the European Economic and Social Committee and the Committee of the Regions, i2010 – Annual Information Society Report 2007, Commission of the European Communities, March 2007 at [http://ec.europa.eu/information\\_society/eeurope/i2010/docs/annual\\_report/2007/070329\\_com\\_en.pdf](http://ec.europa.eu/information_society/eeurope/i2010/docs/annual_report/2007/070329_com_en.pdf)

<sup>58</sup> Korea Institute for Electronic Commerce “e-Health Industry in Korea” 2004 at [http://www.tieke.fi/mp/db/file\\_library/x/IMG/12859/file/05\\_e-HealthinKorea\\_KIEC.pdf](http://www.tieke.fi/mp/db/file_library/x/IMG/12859/file/05_e-HealthinKorea_KIEC.pdf)

<sup>59</sup> 13th annual Healthcare Informatics 100 at <http://healthcare-informatics.com/issues/2006/06/23/>

<sup>60</sup> WHO Global Outbreak Alert and Response Network at <http://www.who.int/csr/outbreaknetwork/en/>

telemedicine applications will be conducted along with joint research and development in the technology<sup>61</sup>.

At the sub-regional level, in the context of implementing e-ASEAN and establishment of the ASEAN Information Infrastructure, the development of region-wide web services, including healthcare, has been in progress<sup>62</sup>. However, other sub-regional entities, such as the South Asian Association for Regional Cooperation (SAARC), are yet to include e-health on the cooperation agenda. Most ICST and health collaboration in the region is done through the ASEAN or groups of health professionals, such as the Asia-Pacific Association for Medical Informatics (APAMI) or the South Asian Public Health Forum (SAPHF).

In short, e-health has not become an important topic for regional collaboration, despite huge growth potentials of the e-health industry and rapidly evolving global dynamism to embrace e-health. However, the establishment of any meaningful regional e-health network should be supported and enabled by the development of health information infrastructure and systems at the national level.

## 6. Challenges

Based on the analysis and assessment in the previous chapters, several characteristics and patterns seem to be emerging. First, **many of the e-health initiatives we examined are stand alone** and/or specialized in one or a few particular aspects of health care delivery. It is unclear how much efforts have been made to maximize the use of existing ICST infrastructure, expertise and resources. Second, **ICST needs of the health sector may not be fully taken into account in national ICTS policies and strategies**, which may mean that ICST infrastructure, services and expertise might not be able to support the development of e-health in the country in a foreseeable future. Third, **only a few countries seem to be aware of full growth potentials of the e-health industry** at the national, regional and global levels and even fewer countries have strategies to seize the opportunity. Fourth, the consequence to the above, **regional and sub-regional initiatives to promote e-health and use of ICST for health have just started** and can be further enhanced.

These phenomena may have been influenced by several factors:

### *a) A disconnect between health and ICTS professionals and decision and policy makers*

An increasing number of countries have included telemedicine or e-health in their national ICST or health policies, strategies and initiatives, while governments, private sector and NGOs have initiated pilot and full-scale e-health/telemedicine projects – many of which show encouraging signs. However, the fundamental question arising from this picture is if all the key stakeholders in both ICST and health sectors have been involved and the need for information sharing and communication among them is taken into account in both sectors, so that the collaboration and cooperation between health and ICST sectors can be ensured in the long term and the investment in health and ICST maximized.

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<sup>61</sup> APEC "From APII to APIS: A Contribution to the World Summit on the Information Society" September 2005 at [http://www.apec.org/apec/apec\\_groups/working\\_groups/telecommunications\\_and\\_information/MediaLibDownload.v1.html?url=/etc/media/lib/apec\\_media\\_library/downloads/som/mtg/2005/pdf.Par.0140.File.v1.1](http://www.apec.org/apec/apec_groups/working_groups/telecommunications_and_information/MediaLibDownload.v1.html?url=/etc/media/lib/apec_media_library/downloads/som/mtg/2005/pdf.Par.0140.File.v1.1)

<sup>62</sup> ASEAN "Roadmap for Integration of e-ASEAN Sector" at <http://www.aseansec.org/16689.htm>

Another question relates to the development of the local, national or regional e-health industry. The existence of reliable service, network and product providers who understand the local context is a must in implementing any e-health initiatives. If harnessed properly, the growth of e-health will present a significant economic opportunity to local ICST and health companies. Harmonized health and ICST standards at the regional level would also help create regional e-health markets. But presently, it seems that there are very few countries where ICST and health professionals and government officials are working together to develop such an e-health industry.

### ***b) A lack of an enabling environment - what it means for e-health***

One of the consequences of the above disconnect is the realization that the health sector alone will not be able to develop necessary ICST infrastructure, legal and regulatory frameworks, capacity, applications and content which are necessary for the successful implementation of e-health.<sup>63</sup> Thailand's telemedicine network project, for instance, has been paused since 2003 due to high operating costs and lack of an enabling legal framework<sup>64</sup>. Limited high speed data communication and telecom infrastructure was cited as the major bottleneck in promoting the widespread use of telemedicine in Bangladesh<sup>65</sup>.

Even when there is connectivity and skilled professionals to apply ICST for improving health services delivery, the lack of accurate and reliable data and information poses a barrier to e-health adoption. The use of local language is frequently neglected in developing software programmes and tools and subsequently little content on health is available in local languages.<sup>66</sup> Another critical aspect is the quality and accuracy of health information publicly available online. Besides, some medical information provided online by a doctor in a country might not be legally and technically valid and suitable in another country.

### ***c) A need for awareness and capacity from the top to the bottom***

The successful integration of ICST into health systems could be strengthened if there is a range of e-health expertise among policy and decision makers as well as health and ICST professionals, in addition to the commitment at the highest political levels. The evolution of e-health requires continuous capacity building among the professionals in the development and implementation of health ICST systems. At the same time, all stakeholders, including end users, should be aware of impacts and implications of new technologies.

### ***d) The problem of an incremental approach***

The current incremental approach of adding a stand alone e-health initiative might not be the optimal way to benefit from ICST and health investments. For instance, many countries have been implementing telecenters in rural and remote areas. One of the objectives of their establishment, in many cases, is to provide health information to the rural population with a view

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<sup>63</sup> "Improving health, connecting people: the role of ICTs in the health sector of developing countries" Edited by Andrew Chetley. InfoDev Task Manager: J. Dubow. 31 May 2006.

<sup>64</sup> Mr. Thiti Phoophet "Thailand and Former Telemedicine", Ministry of Public Health, Thailand, Report prepared for the APT Regional Workshop on Telemedicine, 6-9 February 2007

<sup>65</sup> Sarkar Md. Zayed Robbani "Country Paper by Bangladesh", Bangladesh Telegraph and Telephone Board, report prepared for the APT Regional Workshop on Telemedicine, 6-9 February 2007

<sup>66</sup> It is observed that one benefit of open-source software is the facilitated extension of support to additional languages, where proprietary software might not have such support. Adding support for a national or local language may be done with two or three programmers in a month or so, depending on the software. Expertise exists in the region.

to achieving national development goals, including those that may be related to the Millennium Development Goals. In parallel to these initiatives, other streams of ICT initiatives, such as networking among tertiary and research institutions as well as government agencies, have been implemented. However, more often than not, these initiatives are not considered as part of e-health/telemedicine initiatives or integrated into the national health and ICT policies and strategies.

A comprehensive strategy should aim at both social and economic aspects of e-health, namely (1) more affordable provision of high quality universal healthcare services and (2) development of a vibrant e-health industry which supports such services and contributes to economic growth. In this context, one may aim for a holistic and inclusive approach - instead of an incremental one - to create synergies by positioning e-health into a wider context of the national health information infrastructure and linking it to a national ICST policy framework, taking into account the benefits from regional cooperation and coordination.

## **7. National Health Information Infrastructure**

### **7.1 Why the Health Information Infrastructure?**

The definition of the national Health Information Infrastructure (HII) is wider than telemedicine, tele-health or e-health, since it covers a wider range of stakeholders, networks and services with a stronger linkage to other sections including ICST. Most, if not all, sectors of public services touch on effective e-health. Salah Mandil defines it as

*“health info-structures comprising of systems that contain validated and evidence-based information, accessible by the right and authorized person or institution, from wherever this may be, whenever this may be required and in any format chosen at the moment of access”*<sup>67</sup>

Such HII should include a set of technologies, standards, applications, systems, values, and laws that support all facets of health systems, including individual health, health care and public health. The objective of developing such HII is to deliver information to health systems' stakeholders so they can use this information to make informed decisions about health and health care <sup>68</sup> . HII's stakeholders include end users, healthcare providers, research institutions/laboratories, private sector and government agencies.

By creating a national HII for connecting otherwise incongruent stakeholders and exchanging data and information, greater synergies can be achieved among them: medical research findings can be shared more widely and used in decision making processes at various levels; outbreaks of epidemics and infectious diseases may be detected, monitored and controlled in a timely and effective way; training, skills upgrading and information dissemination can take place for medical practitioners regardless of locations; healthcare management can be more efficient and transparent. Closer collaboration and synchronized efforts by all the concerned sectors could

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<sup>67</sup> Salah Mandil “Tele-health: What is it? Will it propel cross border trade in health services?” International trade in health services: a development perspective, 1998

<sup>68</sup> Don E Detmer, “Building the national health information infrastructure for personal care, health care services, and research”. BMC Medical Informatics and Decision Making, 2003.

minimize the cost of establishing the necessary infrastructure, platforms or systems envisioned by the government.

Some member States, in their national ICST policies and strategies, envisioned the creation of an integrated health information system or network, but based on the above preliminary analysis, the scope of the proposed system or network is rather limited, with the focus on one or two areas, such as research and electronic medical record management. Instead, in order to create synergies and maximise benefits of the investment, the HII should cover all the key stakeholders in the health system, aligning them towards a common vision and objectives.

## 7.2 Needs of various stakeholders

Each stakeholder has different information needs and role to play. This section discusses how ICST can be systematically applied to address the information needs of each stakeholder of health systems and enhance efficiency and effectiveness in providing health information and care as well as making decisions at all levels.

### *(i) Healthcare users*

Personal users of health services may benefit from access to health information where a system is put in place to maintain quality and accuracy of the information. A recent Economist article featured a phenomenal increase in the amount of user-generated online health information and communities, called Health 2.0. Despite concerns over privacy and misinformation, an increasing number of patients exchange information, thus creating a valuable platform, especially for patients suffering from rare diseases<sup>69</sup>. A study also pointed out a considerable demand for health information among the general population: in the US between 56% and 79% of Internet users look for health-related information and in Europe 71% of the Internet users have used the Internet for health purposes<sup>70</sup>. The same study concluded that the Internet users primarily seek health-related information, then decide to see a doctor or not and prepare for/follow up on doctors' appointments.

ICST could also be used to provide a wide range of information, such as latest epidemic outbreaks, health statistics and information on medical facilities, while promoting preventive care and self-care. Some of the examples of health portals are Australia's HealthInsite<sup>71</sup> funded by the Department of Health and the English NHS Direct Online<sup>72</sup>.

Rural and poor areas in developing countries are often prevented from benefiting fully from the use of ICST and the delivery of health services. In many cases, multi-purpose telecenters<sup>73</sup> have been seen as a solution to provide necessary infrastructure and services to remote areas. There is a growing recognition on the importance of the provision of primary health care for those in rural and remote areas. Once all the requirements are met, telecenters could be used for diagnostic medical services through telemedicine and providing public health information. Such information

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<sup>69</sup> "Health 2.0" Economist, 6 September 2007 at [http://www.economist.com/printedition/displaystory.cfm?story\\_id=9719054](http://www.economist.com/printedition/displaystory.cfm?story_id=9719054)

<sup>70</sup> H.K. Andreassen, M. M. Bujnowska-Fedak, C. E. Chronaki, R. C. Dumitru, I. Pudule, S. Santana, H. Voss and R. Wynn, "European citizens' use of E-health services: A study of seven countries" BMC Public Health April 2007

<sup>71</sup> HealthInsite at <http://www.healthinsite.gov.au/>

<sup>72</sup> NHS Direct Online at <http://www.nhsdirect.nhs.uk/>

<sup>73</sup> A multi-purpose telecenters is a shared information and communication facility for people in un-served or under-served areas to facilitate access to email, web browsing, file transfer, electronic libraries, databases, government and community information services.

and services are also vital during epidemic outbreaks and disasters. Telemedicine facilities can assist relief workers by providing them with instant support from remotely located healthcare professionals. Furthermore, telecenters could be used for medical practitioners to update their knowledge and skills which are critical in providing quality care in rural and remote areas.

### *(ii) Research and training institutions*

Health research institutions play key roles in the health system, since they develop knowledge and solutions through research in response to clinical and public health needs of a country. Communication and data sharing among health research institutions is a necessity for fostering collaboration, allowing researchers to work together. A national HII must also connect research centres with medical practitioners, since health data collection from clinics and hospitals gives a pool of anonymous data for research purposes, facilitates national health studies. The University Health Network and University of Toronto of Canada established the Centre for Global e-health Innovation<sup>74</sup>. Its Innovation Lab is designed to support innovative R&D and initiatives. Another example is the German Telematics Platform (Telematikplattform für medizinische Forschungsnetze)<sup>75</sup> supported by the German Ministry of Research and Education for medical research purposes.

The same network can be used to disseminate new discoveries and research findings to clinicians. Staying informed also requires access to the world's medical literature and contact with other international and regional research institutions. In addition, sharing national health data and research findings with regional and international counterparts makes clinical research available across national boundaries.

The World Wide Web (WWW) is becoming an extremely useful resource for health practitioners and the general public, lowering both the cost of publication and distribution. In addition to the examples listed above, an increasing volume of open-access scientific literature has been made available on the Internet at no cost and without any restriction on its use and reproduction. Open-access is gaining ground in medical fields<sup>76</sup>, as it allows combating the knowledge gap by enabling researchers everywhere to stay up-to-date with the latest research if the necessary equipment and facilities are available<sup>77</sup>, and to increase their own research impact<sup>78</sup>. Medical journals in the developing world can also benefit from an open-access model<sup>79</sup>. This increase in the available research literature has become one of the compelling reasons why the academia should be connected to a wider network.

Furthermore, networks with medical training institutes and colleges could help improve the quality of education, in-service training and skills upgrading of medical professionals especially in rural and remote areas. India, for instance, has a plan to link all the medical colleges to bridge the deficiency of teachers and medical library facility<sup>80</sup>. Access to the latest data and information by medical practitioners could enable timely and accurate health interventions.

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<sup>74</sup> Centre for Global e-health Innovation at <http://www.e-healthinnovation.org/>

<sup>75</sup> Telematikplattform für medizinische Forschungsnetze at <http://www.tmf-ev.de/>

<sup>76</sup> "Open access publishing takes off" BMJ 2004; 328 (7430) at <http://www.bmj.com/cgi/content/full/328/7430/1>

<sup>77</sup> Jennifer I. Papin-Ramcharan and Richard A. Dawe "Open access publishing: A developing country view" First Monday 2006 at [http://www.firstmonday.org/issues/issue11\\_6/papin/index.html](http://www.firstmonday.org/issues/issue11_6/papin/index.html)

<sup>78</sup> "The effect of open access and downloads ('hits') on citation impact" The Open Citation Project – Reference Linking and Citation Analysis for Open Archives at <http://opcit.eprints.org/oacitation-biblio.html>

<sup>79</sup> D.K. Sahu "Open Access: Boon for journals from India" at [http://openmed.nic.in/1255/01/OA\\_ISC\\_Jan06.pdf](http://openmed.nic.in/1255/01/OA_ISC_Jan06.pdf)

<sup>80</sup> S.K. Mishra "Indian Country Report on Telemedicine and e-health", report prepared for the ATP Regional Workshop on Telemedicine, 6-9 February 2007

### ***(iii) Government agencies - role of ICST for evidence based decision making***

Public health agencies monitor, promote, and protect the health and safety of the population. They are responsible for public health through planning, education, prevention, emergency preparedness and response, and infectious and chronic disease control. Collecting individual health data and transforming them into pools of anonymous data helps monitoring national health. An HII will serve as a foundation of data collection and analysis, communication among different government entities and government's interface with its citizens in the health sector. The US Centers for Disease Control and Prevention<sup>81</sup> supported by the Department of Health and Human Services and the website of the Ministry of Health of Singapore<sup>82</sup> provide such examples. The compiled and analyzed health data and statistics may also be communicated to international organisations, such as WHO, for comparisons of health system performance in different countries and regional responses to communicable diseases.

In addition, there is a benefit from networking between central and provincial/municipal/rural administrations to ensure timely and reliable communication and information exchange and monitor compliance to national standards and regulations by healthcare providers and professionals, among other tasks. Monitoring and evaluation of health initiatives and quality of health services across a country could be strengthened with the vertical networking.

### ***(iv) Healthcare providers***

Most e-health applications are developed to improve efficiency/effectiveness of healthcare providers. A WHO survey<sup>83</sup> concluded that the following e-health systems have been found useful by health officials: electronic health records, patient information systems, hospital information systems, national electronic registries, national drug registries, directory of medical practitioners, decision support systems and tele-health.

Efficient medical and clinical information management can reduce medication errors, ensure uninterrupted supply of medicine and vaccines and provide enhanced surveillance and monitoring of (potential and actual) epidemics and infectious diseases. ICST may also enhance efficiency and effectiveness of general management of clinics and hospitals. Accurate and timely information enables productivity to be improved, waste to be minimized, resource utilisation optimised and costs contained.

Some countries have developed systems to bring information and knowledge closer to medical practitioners. Australia developed the Clinical Information Access Program (CIAP), an online evidence system providing 24 hours access to information to support evidence based practice<sup>84</sup>. A study<sup>85</sup> found that community wide electronic distribution of summary health care utilization data among healthcare providers helped maximize the use of available facilities and resources within the community and improved access to hospital emergency departments and inpatients

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<sup>81</sup> Centers for Disease Control and Prevention at <http://www.cdc.gov/>

<sup>82</sup> The Ministry of Health, Singapore at <http://www.moh.gov.sg/mohcorp/default.aspx>

<sup>83</sup> WHO "E-health Tools and Services: Needs of the member States" at [http://www.who.int/entity/kms/initiatives/tools\\_and\\_services\\_final.pdf](http://www.who.int/entity/kms/initiatives/tools_and_services_final.pdf)

<sup>84</sup> J. Westbrook, M. West Brook and A. Gosling, "Ambulance officers' use of online clinical evidence", *BMC Medical Informatics and Decision Making*, 2006, 6;31

<sup>85</sup> R. Lagoie and G. Westert, "Community wide electronic distribution of summary health care utilization data", *BMC Medical Informatics and Decision Making*, 2006, 6;17

units. These are just a few examples of an increasing array of e-health applications and systems established to enhance efficiency and effectiveness of the health care delivery.

#### **(v) Private Sector**

The private sector can play multiple roles in implementing and enhancing a national HII. Pharmaceutical companies can undertake joint research with academia for the development of medicine and vaccines. Information, including updates, made available on existing drugs could help rural health practitioners, among others, to avoid errors in prescription. According to a report, 7,000 die and 1.5 million people are harmed by preventable medication errors annually in the US. An e-prescription initiative was introduced to the US in January 2007 to avoid such medication errors<sup>86</sup>. At the same time, the HII can enhance information exchange between healthcare providers and companies which are engaged in the development of e-health systems and appliances.

### **7.3 Interoperability**

In realizing visions of the national HII, it is imperative to ensure interoperability and smooth exchange of data, information and services among different stakeholder systems and applications. In terms of e-health applications, national, regional or global standards of electronic medical or patient records could help exchange information throughout and beyond any individual country. Standardized electronic hospital records, for instance, will significantly reduce costs and risks associated with developing hospital systems. Backward interoperability is also a critical factor in enabling existing medical and patient records accessible in any new systems.

Exchanges of data with national, regional and international counterparts and interoperability in the national HII can only succeed if a common set of standards and procedures is established and agreed to among the stakeholders. With this objective, various initiatives toward global standards have been implemented:

- Unified Medical Language System (UMLS): a controlled compendium of medical vocabularies;
- SNOMED CT®, or Systematized Nomenclature of Medicine Clinical Terms: a computerized clinical terminology covering clinical data for diseases, clinical findings, and procedures;
- Digital Imaging and Communications in Medicine (DICOM): a set of standards for handling, storing, printing, and transmitting information in medical imaging;
- Health level Seven (HL7): message specifications for pharmacy, medical devices, imaging and insurance transactions<sup>87</sup>
- International Classification of Diseases (ICD-9) for classification of diseases<sup>88</sup>.

Most e-health activities of various stakeholders revolve around data exchange and processing, which require efficient, reliable and robust ICST infrastructure, data processing facilities and standards. Interoperability and open standard<sup>89</sup> are also critical in developing products and

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<sup>86</sup> "Doctors offered electronic prescription systems" Washington Post 16 January 2007 at <http://www.washingtonpost.com/wp-dyn/content/article/2007/01/16/AR2007011600887.html>

<sup>87</sup> Health level Seven at <http://www.hl7.org/>

<sup>88</sup> International Classification of Diseases, Ninth Revision, Clinical Modification at <http://icd9cm.chrisendres.com/>

<sup>89</sup> The definition of Open Standard at [http://en.wikipedia.org/wiki/Open\\_standard](http://en.wikipedia.org/wiki/Open_standard) and <http://www.itu.int/ITU-T/othergroups/ipr-adhoc/openstandards.html>

services at the national, regional and international levels, thus creating an enabling environment for the e-health industry to thrive. A recent research<sup>90</sup> speculates that open standard and open-source software each support the other and, more interestingly, successful open standards seem to always have at least one OSS implementation.

#### **7.4 Maximizing e-health Investments: the Open-Source alternative**

Open-source software (OSS) designates software under a specific license that grants to anyone royalty-free rights to use, study, modify and redistribute both the source code and the final software.<sup>91</sup>

One immediate advantage of using OSS is a reduced licensing cost, as there is no software licensing fee. Another advantage is a relative independence from vendors: since any system integrator has access to the source code of the OSS software, there is no “vendor lock-in” and therefore multiple suppliers of services for a client to choose from: more competition usually means lower price.<sup>92</sup> And, by granting full access to the source code without any royalty, OSS enables local entrepreneurs to provide a greater share of added value, from support to customization and localization to local language and cultural sensitivity: a greater share of profits stays within the local economy<sup>93</sup>.

OSS solutions cover various aspects of e-health, with VistA (health care information system), FreeMed (practice-management and EMR system), Hospital OS (Hospital Information System for managing hospital operations made in Thailand) and Care2x (integrated Healthcare environment), providing components for hospital/health service information systems, practice management, central data server and health exchange protocol<sup>94</sup>. The Open Source Health Care Alliance<sup>95</sup> is one of the pioneering advocates for this collaborative, peer review approach to software development and dissemination in the health sector.

OSS is becoming increasingly popular in Asia and the Pacific: open source software is now used by over 70 per cent of software developers in Asia, according to a report by Evans Data Corporation<sup>96</sup>. The OSS community in Asia-Pacific is also growing, from Linux user groups in over 25 countries from Armenia to Viet Nam. A vibrant local OSS industry could be one way of achieving a long-term sustainable cycle of development, implementation and support of e-health applications and systems.

#### **7.5 Emerging e-health Technologies**

Any considerations of e-health information infrastructure should take into account emerging e-health technologies. Such technologies should be dynamic and flexible enough to meet linguistic and infrastructural requirements of developing countries and help promote health objectives of the country. Some examples for consideration include the following:

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<sup>90</sup> “Open Standards, Open Source” at <http://www.dwheeler.com/essays/open-standards-open-source.html>

<sup>91</sup> Open Source Initiative at <http://www.opensource.org/>

<sup>92</sup> Jyh-An Lee “New Perspectives on Public Goods Production: Policy Implications of Open Source Software” at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=963491](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=963491)

<sup>93</sup> Rishab Ghosh “The Economics of Free Software - and why it matters for developing countries” at <http://flossproject.org/papers/20051116/wsis-tunis-nov05-GHOSH.pdf>

<sup>94</sup> California Healthcare Foundation “Open Source Software: A primer for Health Care Leaders” March 2006 at <http://www.chcf.org/topics/view.cfm?itemID=119091>

<sup>95</sup> The Open Source Health Care Alliance at <http://www.oshca.org/>

<sup>96</sup> “Open Source Booming in Asia” vnunet.com 8 December 2006 at <http://www.vnunet.com/vnunet/news/2170549/open-source-grows-asia>

### ***(i) Geo-informatics***

Geo-informatics, including geographic information systems (GIS), has increasingly been used in such healthcare applications as (1) understanding the spatial context of public health issues, (2) routing ambulances to reach a victim quickly and transport said victim most quickly to appropriate medical care, and (3) early detection of patterns that might indicate evolving outbreaks – such as of avian flu or cholera.

At the First International Symposium on Health GIS<sup>97</sup>, held in Bangkok in December 2005, several hundred participants collectively realized that GIS and remote sensing had demonstrated value to support improved health care – in many cases beyond their own expectations. They noted that people in research, healthcare public and commercial services had an opportunity to make great progress toward globally benefiting peoples with operational adaptations of such technology.

However, major gaps in awareness still existed – mostly among health services policymakers, and the many health care professionals who were still largely unaware of the readiness of such approaches to deliver positive results now. Participants noted imperfections in data, information, and some current applications – but noted that improvements would come with additional time, greater awareness by policymakers, and engagement with operational medical services<sup>98</sup>.

### ***(ii) Radio frequency identification (RFID) and other wireless technologies***

RFID tags transmit the identity of an object or person wirelessly, using radio waves<sup>99</sup>. In addition to the emerging leading usage of pharmacy stock management, a study by Health Industry Insights<sup>100</sup> identified wider potential usage of RFID for hospitals to track bio specimens, assets and persons. According to one study<sup>101</sup>, RFID technologies have already added \$40 billion in benefits to the retail and health-care sectors. Another indirect advantage of RFID is that their introduction usually improves the entire business process<sup>102</sup>.

More generally, wireless technologies enable health professionals to easily access and input new information about the patient, and consult medical references wherever they are, through personal digital assistant (PDA), tablets PC or cell phones, enabling a faster and more accurate service. The coverage and affordability has been improving rapidly in developing countries in the region. For instance, Short Message Service (SMS) will soon be used in India to transmit physiological data, such as blood pressure, to a doctor's mobile phone through a connected measuring device<sup>103</sup>. A recent article reported that researchers in Singapore succeeded in creating a handheld device to detect avian flu virus from throat swab samples<sup>104</sup>.

### ***(iii) Wiki***

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<sup>97</sup> First International Symposium on Health GIS 2005 at <http://e-geoinfo.net/HealthGIS/Main.htm>

<sup>98</sup> David Hastings, "Brainstorming the Policy Ramifications of Health GIS: Summarizing Policy and Technical Next-Steps towards Operationalizing Health Geoinformatics" International Journal of Geoinformatics, v. 2, No. 4, 2006 reports on this meeting.

<sup>99</sup> What is RFID?" RFID Journal at <http://www.rfidjournal.com/article/articleview/1339/1/129/>

<sup>100</sup> "RFID Market to Exceed \$14 billion in Life Sciences" RFID Journal at <http://www.rfidjournal.com/article/articleview/2634/>

<sup>101</sup> Beth Bacheldor, "Study Finds High Economic Gains from RFID Developments" RFID Journal 13 Dec 2006 at <http://www.rfidjournal.com/article/articleview/2889/>

<sup>102</sup> While RFID and wireless technologies can enable health professionals to work better, there is uncertainty about the long term health impact of electromagnetic fields exposure in daily life.

<sup>103</sup> "Now, telemedicine set to SMS blood pressure report to our doc" Chandigarh Newline 9 September 2007 at <http://cities.expressindia.com/local-news/fullstory.php?newsid=255522>

<sup>104</sup> "Scientists created device to detect H5N1" Reuters at <http://www.reuters.com/article/scienceNews/idUSHKG9283520070923>

A wiki is a web site whose content can be edited by everyone, without any particular technical skills, allowing a community to collaborate and create a document. Wikipedia is the most popular example of it. Medically oriented wikis, such as Ask DrWiki<sup>105</sup>, have been initiated<sup>106</sup> and the spirit of openness and collaboration have spurred dynamic interactions among medical professionals<sup>107</sup>. WHO is using a similar online collaborative tool to revise the global standard for medical and health statistics - the International Classification of Diseases (ICD)<sup>108</sup>.

Although the use of wiki has been spreading rapidly, there have been sceptical views on reliability and accuracy of medical information, especially on wiki. A study in the BMJ<sup>109</sup> showed that, with the appropriate keywords, Google searches made by a doctor revealed the correct diagnosis in 58% of the case. Some believes that inaccurate information could eventually be corrected by experts and qualified medical professionals (See 7.2).

#### ***(iv) Weblog***

Weblogs, just like wikis, allow easy publishing and conversation on the Web and a number of medical weblogs have been emerging<sup>110</sup>. Coupled with web syndication (like RSS<sup>111</sup> and ATOM<sup>112</sup> feeds that distribute recent changes to a website in an automated way<sup>113</sup>) and dedicated tools like feed aggregators and weblogs increase the efficiency of content sharing and information delivery.

#### ***(v) Podcast***

Podcasts and videocasts (audio and video files distributed via syndication feeds) are also used by medical professionals to converse and exchange facts and experience via the Web. While they demand a bit more technical skills and hardware to produce the content, they might be more suited for (re)broadcasting on radio or television, than more text-based media like wiki and weblogs.

#### ***(vi) Why these tools matter***

By lowering requirements to create and maintain content and websites, an increasing number of medical professionals, users and policy and decision makers have been able to share data, information and knowledge in an unprecedented scale. Among other tools, RFID and health geoinformatics help government officials and health professionals make informed and evidence-based decisions on a daily basis. Accelerated by the introduction of OSS, e-health applications have increasingly become affordable to a wider range of stakeholders in the context of developing countries.

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<sup>105</sup> Ask Dr.Wiki at [http://www.askdrwiki.com/mediawiki/index.php?title=Main\\_Page](http://www.askdrwiki.com/mediawiki/index.php?title=Main_Page)

<sup>106</sup> A list of medical wikis at <http://davidrothman.net/list-of-medical-wikis/>

<sup>107</sup> "How Web 2.0 is changing medicine: Is a medical wikipedia the next step?" at <http://www.bmj.com/cgi/content/full/333/7582/1283>

<sup>108</sup> WHO "WHO uses web-based approach to revise global disease standards" at

<http://www.who.int/mediacentre/news/releases/2007/pr13/>

<sup>109</sup> Hangwi Tang, Jeniffer H.K. Ng "Googling for a diagnosis—use of Google as a diagnostic aid: Internet based study" BMJ 2006;333:1143-1145 (2 December) at <http://www.bmj.com/cgi/content/full/333/7579/1143>

<sup>110</sup> MedBlog.nl at <http://medblog.nl/medblogen/>

<sup>111</sup> RSS = Really Simple Syndication. The definition can be found at <http://en.wikipedia.org/wiki/RSS>

<sup>112</sup> The Atom syndication format is an XML language used for web feeds. More at <http://en.wikipedia.org/wiki/ATOM>

<sup>113</sup> BBC "Introduction to Web syndication" at <http://news.bbc.co.uk/2/hi/help/3223484.stm>

These pieces of puzzle will fit into place if there is a holistic vision and comprehensive strategy. With a policy and understanding among the key stakeholders, health information and knowledge can be shared more efficiently and effectively. However, the strategy should also be anchored in the realm of ICST infrastructure, expertise, industry and policy and regulatory environment.

## **8. Findings of the Study**

E-health has been evolving rapidly around the world. In Europe and the United States, various e-health initiatives and policies have been put in place to address challenges of providing universal health care and improving quality of health care services in a cost efficient manner. In a more specific term, e-health has been introduced to improve patient safety, inefficiencies experienced by users and providers, productivity among medical professionals and decision making processes.

This study reviewed previous research conducted to determine various cost saving factors of e-health as part of rationale for introducing e-health. Although these figures can't be applied to all the countries with different health systems, they indicate potential cost saving by introducing e-health. For instance, the introduction of electronic prescription alone is estimated to save at least \$29 billion a year in the United States. In Australia, improved access to medical knowledge, among other elements, would save more than \$1.3 billion per annum. This study also found that the impact of e-health on health outcomes ranges from enhanced cost-efficiency to better adherence to medication, patient monitoring and reduced re-admission, although this is not an exhaustive list.

In Asia and the Pacific, a number of e-health initiatives have been planned and implemented. This study categorised them into 4 clusters of a) development of infrastructure, networks and standards; 2) electronic healthcare management; 3) telemedicine/tele-health and 4) integrated health systems. It seems that a few countries started moving towards the development of an integrated health system. This study also analyzed 25 ICST policies, plans and strategies, in addition to national health policies and plans. It found that 32% of the analyzed ICST policies and plans didn't have health as a key component, while some focus on specific areas of health, such as basic health, R&D and enhanced health service delivery. The study also noted that although a significant growth of the e-health industry is expected worldwide, companies in the region are not considered as a major player, yet. As a result of the above conditions, e-health is not tabled as a priority issue by sub-regional organizations, with the exception of the ASEAN.

Based on the overall assessment, four characteristics on the e-health development in Asia and the Pacific were identified. First, many of the reviewed e-health initiatives are still stand alone and/or specialised in one or a few aspects of health care delivery. Second, ICST needs of the health sector are not fully taken into account into national ICST policies and strategies in many countries. Third, only a few countries are aware of the full potential of the e-health industry and even fewer countries have strategies to seize the opportunity. Finally, e-health has not become the priority area of sub-regional and regional cooperation, yet. The study also assessed the factors which might have influenced these phenomena, such as a disconnect between health and ICST professionals and policy and decision makers, lack of an enabling environment, need for awareness and capacity from the top to the bottom and a problem of an incremental approach.

In order to overcome these shortcomings, this paper proposed the concept of the national health information infrastructure which connects all the key stakeholders of healthcare users, research and training institutions, government agencies, healthcare providers and private sector. The chapter was followed by discussions on interoperability, Open-Source Software as technical alternative and emerging technologies.

The concept of the national health information infrastructure is not new: in fact WHO proposed it already in the late 90s. The challenges member States have been facing in promoting universal health care and improving the quality haven't drastically changed. What has changed is the technology landscape and emergence of new components, such as wiki, blog and podcast, which have been empowering each stakeholder to play more proactive role and reinforcing the importance of networking among them.

## **9. Policy Recommendations**

Improving national health is a major step in achieving internationally agreed development goals, such as those contained in the Millennium Declaration and WSIS Plan of Action. The development of e-health and national health information infrastructure can make these improvements happen faster, more effectively and cost-efficiently. Based on the findings, this study proposes the below three recommendations although they are not exhaustive:

### **9. 1. Formulation of an integrated health ICST policy and strategy**

As a first step, an enabling policy, as a manifestation of national consensus, should be put in place. This policy could be part of the national ICST and/or health policies or strategies. As an alternative, a government might decide to formulate an independent health and ICST policy and strategy. In whichever case, the establishment of the health information infrastructure should be embedded as a key component of national ICST and information society development with a clear vision.

One success factor in such an attempt could be a participatory approach. All key stakeholders, including ICST and health private sector and policy and decision makers, should be involved and consulted in order to ensure that their aspirations and requirements are taken into account. With the vision and objectives of e-health agreed at the national level, it would be easier to identify the gap between the goals and existing ICST infrastructure, resources, policy and legal frameworks. ICST and health professionals may also wish to undertake an e-health readiness assessment of all the identified players, including government agencies and healthcare providers. Accordingly, strategies and implementation plans could be formulated with appropriate financing plans. It is also important that the periodic monitoring and assessment is done by both health and ICTS decision and policy makers and the public at large is informed of the development and engaged in the process.

In order for this to happen, awareness and capacity built among ICST and health policy and decision makers in the formulation, implementation, monitoring and evaluation of such an ICST and health strategy would be critical. Such awareness and capacity could also cover issues, such as various financing mechanisms, internationally recognized standards and new and emerging ICST developments which could minimize the investment, while maximizing the value of available infrastructure and resources.

## **9. 2. Legal issues**

The operationalization of the national health infrastructure should include the establishment of appropriate legal and regulatory frameworks. Not all health data and information are for public consumption. The appropriate level of privacy and confidentiality need to be taken into account and ensured through these instruments. A legal framework must be set up to support data reliability (data in health infrastructure systems must be accurate), security (storage and transmission are secure) and confidentiality (the subject can control the use and the dissemination of the information). Such a framework needs to be monitored by an independent, neutral authority.

There must also be a legal framework to enhance confidence among users in using such systems, while anticipating the need for harmonization of data exchange, health and ICT policies and laws at the regional level. A wider rollout of telemedicine, for instance, prompts a new set of issues that need to be addressed with adequate legal and regulatory tools, including possible cross-border telemedicine services and financial reimbursement of remote acts. These issues can be regulated with certification or license for operation, recognized at the national or regional levels. A systematic and sustained provision of cross-border telemedicine services requires a policy, regulatory and legal framework as well as robust health information infrastructure at the national level as a foundation.

## **9.3. e-Health as a growth industry**

The need for local expertise in e-health can be a source of business, both for healthcare and ICST professionals. Policies could focus on the development and promotion of an e-health industry, support professional development and eventually help retain e-health ICST expertise in health systems and provider organizations. The development of an e-health industry could create more employment opportunities, especially among the youth, promote export of ICST applications, products and services, and eventually contribute to economic development. The growth of the industry could help advance the health and ICST agenda as well as act as an enabler of the economic development of a country.