eTransform Africa: Health Sector Study

Sector Assessment and Opportunities for ICT

March 6, 2012
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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ATM</td>
<td>Automatic Teller Machine</td>
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<tr>
<td>CDC</td>
<td>Centre for Disease Control</td>
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<td>CDMA</td>
<td>Code Division Multiple Access</td>
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<td>CHF</td>
<td>Community-based Health Financing</td>
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<td>EEPCO</td>
<td>Ethiopian Electric Power Company</td>
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<td>eHealth</td>
<td>Electronic Health</td>
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<td>EmONC</td>
<td>Emergency Obstetric and Neonatal Care</td>
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<td>EMR</td>
<td>Electronic Medical Record</td>
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<td>FMOF</td>
<td>Federal Ministry of Finance</td>
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<td>FMOH</td>
<td>Federal Ministry of Health</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GHS</td>
<td>Ghana Health Service</td>
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<td>GOe</td>
<td>Global Observatory for eHealth</td>
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<td>GSM</td>
<td>Global System for Mobile Communications</td>
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<tr>
<td>HEF</td>
<td>Health Extension Program</td>
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<td>HEW</td>
<td>Health Extension Worker</td>
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<tr>
<td>HIS</td>
<td>Health Information System</td>
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<tr>
<td>HISP/BEANISH</td>
<td>Health Information Systems Programs/Building Europe-Africa Collaborative Network for Applying IST in Healthcare Sector</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>HIV/AIDS</td>
<td>Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome</td>
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<td>HMIS</td>
<td>Health Management Information System</td>
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<td>HSDP</td>
<td>Health Sector Development Plans</td>
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<td>ICT</td>
<td>Information and Communication Technologies</td>
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<td>ICT4D</td>
<td>Information Communication Technologies for Development</td>
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<td>ID</td>
<td>Identification</td>
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<td>IFF</td>
<td>Illicit Financial Flows</td>
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<td>IHISM</td>
<td>Integrated Healthcare Information Services Through Mobiles</td>
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<td>IMCI</td>
<td>Integrated Management of Childhood Illness</td>
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<td>IFRI</td>
<td>Institut Francais des Relations Internationals</td>
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<td>ITN</td>
<td>Insecticide Treated Net</td>
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<td>ITU</td>
<td>International Telecommunication Union</td>
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<td>IVR</td>
<td>Interactive Voice Response</td>
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<td>JSI</td>
<td>John Snow Inc.</td>
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<td>LMIS</td>
<td>Logistics Management and Information System</td>
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<td>MDG</td>
<td>Millennium Development Goals</td>
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<td>mHealth</td>
<td>Mobile Health</td>
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<td>McIT</td>
<td>Ministry of Communication and Information Technology</td>
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<td>MHz</td>
<td>Mega Hertz</td>
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<td>MoTech</td>
<td>Mobile Technology for Community Health</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>NGO</td>
<td>Non-Government Organization</td>
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<td>PEPFAR</td>
<td>President’s Emergency Plan for AIDS Relief</td>
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<td>PPP</td>
<td>Purchase Power Parity and Public-Private Partnership, as the case may be</td>
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<td>RAFT</td>
<td>Réseau en Afrique Francophone pour la Télémédecine</td>
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<td>RCP</td>
<td>Rural Connectivity Program</td>
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<tr>
<td>SMS</td>
<td>Short Message Service</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
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<tr>
<td>UN-HABITAT</td>
<td>United Nations Human Settlements Programme</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>WB</td>
<td>The World Bank</td>
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Project Description

Vital Wave Consulting has been selected by eTransform Africa, a partnership between the World Bank (WB) and the African Development Bank, with the support of the African Union, to research, analyze and generate eTransform Africa: Health Sectoral Study as part of a new flagship report on how information and communication technologies (ICTs), especially mobile technologies, can change fundamental business models in key African economic sectors.

eTransform Africa intends to raise awareness and stimulate action among African governments and development practitioners on how ICTs can stimulate new economic and social activities while developing methodologies to achieve scalability, insure sustainability and mitigate risks.

A project kick-off meeting was held with key project representatives of Vital Wave Consulting, the World Bank, the African Development Bank and the African Union in February 2011 in Nairobi, Kenya. The peer review meeting was held with various stakeholders in Johannesburg, South Africa in June 2011.

Summary

Recommendations: Policy-makers, Regulators, Administrators and Project Managers

The recommendations this report offers to policy-makers, regulators, administrators and project managers are meant for those who participate in and influence the delivery of ICT in health solutions within African countries and across Africa. The recommendations will help policy-makers, administrators and project managers to:

- Design strategies with appropriate and sustainable ICT environments for health sector interventions
- Implement interventions that produce desirable and measurable results
- Evaluate the impact of these interventions
- Develop fast-track options for multi-country collaborations

The summary recommendations are as follows:

Recommendation #1: Create a scalable eHealth architecture governed by rules that are based on principles
Recommendation #2: Combine needs assessment, situation analysis and infrastructure/assets assessment to map interventions
Recommendation #3: Create forums to bring decision-makers together
Recommendation #4: Create incentives for partnerships and cross-sector collaboration
Recommendation #5: Phase interventions to institutionalize the use and maximize the impact of ICT
Recommendation #6: Encourage development of platforms with cross-sector potential
Recommendation #7: Use healthcare to lay the groundwork for a national ID system
Recommendation #8: Require and incentivize impact measurement
Recommendation #9: Conduct total cost of ownership (TCO) analyses
Recommendations: Donor Community

Though policy-makers have the central role in setting a course for eHealth development in their societies, many African countries remain heavily dependent on donor funds and expertise. Therefore, the donor community plays a critical role in supporting and enabling sustainable and scalable eHealth. The following recommendations will be most relevant to those who fund projects and developments within the health sector in African countries and across Africa. The recommendations will help donors and other health sector investors to:

- Design a course of action to include ICT in planning discussions with policy-makers when considering developmental investments
- Designate a role for the public and private sector, keeping in mind that government is a lead user and regulator of ICTs while the private sector is primarily a lead provider—even in cases of public-private partnerships

The summary recommendations are as follows:

- **Recommendation #1:** Incentivize policy-makers to create and use eHealth architecture based on rules and principles
- **Recommendation #2:** Establish and use a cross-agency resource platform for donors to share idea, standardize metrics and combine resources
- **Recommendation #3:** Encourage dialogue, partnerships and collaboration between healthcare decision-makers
- **Recommendation #4:** Archive impact assessments for all projects to be used by future project stakeholders
- **Recommendation #5:** Encourage and reward cross-sector and public-private partnership efforts in eHealth systems development
- **Recommendation #6:** Institute alignment between donors and discourage donor-specific ICT interventions

Definitions and Analytical Framework

According to a World Health Organization (WHO) Global Observatory for eHealth (GOe) survey, 83% of 112 surveyed countries identified at least one mHealth program and 33% identified at least one telemedicine program within their country. Unsurprisingly, high-income countries, which have the most advanced enabling environment, are more likely to have fully established, institutional eHealth programs than are upper-middle, lower-middle and low-income countries. In contrast, the 31 African countries that responded to the survey and their lower-income counterparts were the least likely to have established, institutional eHealth programs in mHealth, telemedicine or eLearning. When these programs exist, they are in either the pilot or informal stages of development. Yet the fact that over 67% of the 46 African countries that are WHO members responded to the survey—a response rate only slightly lower than South-East Asia (73%) and Europe (68%)—is encouraging. This indicates a willingness and, perhaps, eagerness to “mainstream” eHealth as a cost-cutting and life-saving tool.

This report defines eHealth as the use of information and communication technology (ICT)—such as computers, mobile phones, satellites, applications, information systems and digital platforms—to enable, support and deliver health services to patients and populations. It identifies mHealth, telemedicine and eLearning as the three types of eHealth solutions developed and deployed around the world and in African countries. For most of these countries, the backbone of their eHealth framework is some form of Health Management Information System (HMIS) or Health Information System (HIS). ICT use within healthcare systems seems to increase with certain variables that are more likely to exist in upper-income countries and less likely to exist in low-income countries. These variables include top-down political support, financial commitment, human capital and technology transfer. More specific indicators of
ICT use include Gross Domestic Product (GDP) per capita, per capita spending on health (as a percentage of GDP), health sector education, affordable health insurance, and private and public-private investments in the health sector.

This report considers these factors to propose a five-phase framework for the adoption and use of ICT within a country’s healthcare systems. While the first two phases are characterized by a society’s focus on behavioral changes, the middle and latter two phases make greater use of ICT to extend and improve interventions. The framework assumes a desire by the health sector stakeholders to enhance healthcare access and service quality to levels on par with upper-income countries. The report highlights how ICT can be used to accelerate progression within and between phases.

**Health Trends**

The report discusses improving health trends but points to the need for significant improvements. According to the WHO, global health service delivery improved between 1990 and 2009. With some exceptions, the rates of improvement have been higher amongst African countries than most others. Measuring progress towards achieving the Millennium Development Goals (MDGs), African countries have found more success, relatively, with MDG 6 (combat HIV/AIDS) than with MDGs 4 (reduce child mortality) and 5 (improve maternal health).

MDG 4 saw global reductions in under-five mortality from 89 to 60 per 1000 lives, yet 22,000 still die each day. The rate of decline remains too slow in Sub-Saharan Africa, one of three regions in which rates did not decline by at least 50% between 2000 and 2009, thus jeopardizing the region’s ability to achieve MDG 4. Mortality concentration is also a concern as under-five child mortality remains 20 times (1 in 8) as severe in Sub-Saharan Africa as it is in OECD regions (1 in 167) and 1.75 times higher than in Southern Asia (1 in 14). Some countries such as Eritrea, Liberia, Ethiopia and Madagascar (4 of the world's top-10 performers) reduced under-five deaths by at least 100 per 1,000 live births. Northern African countries showed the most improvement with most of their under-five mortality figures falling at or below 40 per 1,000 live births.

The UN’s progress report on MDG 5 exposed a lack of skilled healthcare workers at the time of birth as a primary cause of maternal mortality. To address this issue Northern African countries increased births attended by skilled professionals by 74% between 1990 and 2008. This contrasts with the trend in Sub-Saharan Africa where less than half the births were attended by skilled healthcare workers, and only 37% of rural women received the four recommended visits with skilled healthcare workers during their pregnancy.

Global reduction of HIV/AIDS—one of the goals of MDG 6—were driven by decreases in Africa. Education about the dangers of HIV/AIDS and the need to use protection is a key driver to this progress. Twenty-two out of 33 countries in which there was a 25% decline or stabilization of HIV infections between 2001 and 2009, were African countries. In fact, Sub-Saharan African countries experienced a decrease in HIV prevalence for adults between ages 15-49 between 2001 (5.9%) and 2009 (5.0%). And, new infections amongst adults and children declined from 2.2 million to 1.8 million during the same period, indicating that interventions are yielding results. Nonetheless, out of the 33.3 million people living with HIV in the world in 2009, 69% of these lived on the African continent, meaning 22.5 million (2.25%) of Africa’s 1 billion inhabitants are infected by the virus. Specifically, Botswana continues to combat very high rates of HIV/AIDS, overshadowing its exemplary economic performance in which per capita GDP grew by over 7% per annum from 2005-2008.

MDG 6 also focuses on reducing malaria, which for many African countries is a perpetual killer of children under the five. With 225 million cases worldwide in 2009 and 765 million Africans still at risk, African countries still accounted
for 91% of the nearly 781,000 malaria deaths in 2009 - 85% of which are children under five. From 1981 to 2009, malaria claimed at least 25 million African lives (an average of almost 1 million lives per year). The UN notes that malaria remains at least as large a threat to the African continent as HIV/AIDS. The incidence rate of malaria continues to increase even in locations such as Rwanda, São Tomé and Príncipe and Zambia where it had previously decreased, prompting the WHO to recommend a more vigilant disease monitoring, data collection and malaria control system. An increase in insecticide treated nets (ITNs) has had a positive impact on the populations of Rwanda, Kenya, Madagascar and Ethiopia, to name a few.

This report makes a case for the use of ICT as a “game-changer” that could help African countries overcome the remaining challenges to achieve MDGs 4, 5 and 6, and improve their health systems from Phase 2 and 3 to 4 and 5. This case includes a justification of the cost of ICT based on the benefits it brings, including more efficient use of resources. Rather than depriving other areas of the health system of resources, investment in ICT serves to amplify the impact of those resources by improving accuracy, extending services to underserved areas, and cutting waste and redundancy. These are critical issues in the health sector according to Dr. Margaret Chan, the WHO Director-General, who claimed in Health Systems Financing: The Path to Universal Coverage (WHO, 2010) that “…20% to 40% of all health spending is currently wasted through inefficiency…”

ICT can also be used to address the main obstacles to providing affordable quality healthcare in African countries. According to the literature, those obstacles include funding shortage, equipment and supplies shortage, insufficient quantity of skilled healthcare workers, populations who are uneducated about prevention and treatment of preventable diseases, lack of health system infrastructure and communication between urban and rural areas.

Healthcare systems on the African continent need US$25-30 billion in investment to fund 600,000 hospital beds; personnel including 90,000 physicians, 500,000 nurses and 300,000 community health workers; and retail and distribution networks that will guarantee delivery of supplies and services. The International Finance Corporation (IFC) and other private equity entities are promoting the role that the private sector and public-private partnerships can play in filling this funding gap, while policy-makers and analysts remain sensitive about the adverse impact that fee-based funding and over-dependence on external donor funding can have on poverty in the long term. Many analysts emphasize the importance of including community health financing, micro-insurance and standard insurance programs in the financing mix. Finally, the Institut Francais des Relations Internationales (IFRI) recommends the use of ICT to increase fiscal efficiency for hospitals but warns that cost control cannot replace sustainable funding.

With the impact that mobile-based ICT has already made for consumer communication and financial transactions, cooperation between the health and financial services sectors could yield mutually-beneficial business and financing models. These models could use ICT to enable and simplify consumer and institutional healthcare service delivery funded by out-of-pocket and insurance transactions. The potential benefit would make universal coverage possible for countries such as Rwanda, which currently allocates 19.5% of its total annual spending (or US$37 per capita) for basic service health insurance coverage.

This report also highlights supply chain issues that impede procurement and delivery of equipment and medical supplies. Improving the supply chain is one of the top three goals for developing health systems. This issue can be addressed by a mobile supply chain management and equipment tracking system in which mobile devices (phones, PDAs, tablets, laptops) are used for data collection and monitoring. With the appropriate device and application set, the cost of traditional data gathering and resource allocation could be greatly reduced.
The insufficient quantity of skilled healthcare workers is especially acute in Africa, particularly among Rural Health Extension Workers (RHEWs). By implementing SMS-based mobile and online training capabilities using municipal or private broadband infrastructure, it will be possible to promote best practices for (and between) health workers in African countries. The francophone RAFT (Réseau en Afrique Francophone pour la Télémédecine) network does a good job of this in Mali, Senegal, Cote d'Ivoire and Burkina-Faso.

ICT can increase access to educational material about preventing and treating preventable diseases. The 2010 MDGs report indicates a significant increase in knowledge about HIV across the continent. Disease prevention and treatment information can be disseminated through a variety of technology-based methods. Current programs use quizzes and information hotlines (Ethiopia), mobile phone SMS (Tanzania) and Interactive Voice Response (Ghana) systems. Further examples include Cell-Life and Project Masiluluke in South Africa, and Text to Change in Uganda.

Rural areas do not have equal access to information as urban centers. ICT can help change that. While many countries are increasing their physical plant in the form of additional clinics in rural areas, communication between rural healthcare extension workers (HEWs) and trained nurses and doctors in peri-urban facilities can be accomplished with SMS, image delivery and video phone systems (e.g., TeleDermatology in Egypt and Ikon Tele-radiology in Mali). Information and metrics analysis solutions such as JavaROSA (currently used in Kenya, South Africa, Tanzania, Uganda and Zambia) can also help resolve the issue of rural-urban healthcare disparity.

ICT can also be used to reduce under-five child mortality by improving supply chain management to increase access and streamline the deployment of antibiotics, oral rehydration, vaccinations and mosquito nets. Also, mobile, SMS, Interactive Voice Response (IVR) and video technologies can make it possible to administer short-term and mid-term training regimens for HEWs. These same technologies can be used to identify and resolve health issues, including epidemics, more proactively. Finally, databases, as part of modular and national HIS (health information systems) allow cross-analysis of patient information (e.g., child weight loss) to drive evidence-based decision-making at the individual, group, community and national levels.

ICT can be used to improve maternal mortality by making it possible to increase pre-natal consultation with professional healthcare workers and deliveries attended by skilled birth attendants. Mobile-based training and monitoring (MoTeCH in Ghana and RAFT in Senegal) will prove more valuable as GSM and CDMA networks and subscription penetrate rural areas, and even more so when mobile broadband services become a part of the national communication service offering. At that point, health extension workers will have access to nurses and doctors via mobile phones, text message or video chat when problems arise. The infrastructure is already available in some countries, such as Ethiopia, which has a CDMA 450MHz network that covers 90% of the rural population and at least one community phone in 15,000 of 18,000 kebeles (communities). These technologies could be used for more efficient data collection. In Uganda, for instance, the Ugandan Health Information Network experienced a 25% cost savings in the first 6 months as a result of the ability to use ICTs to inform patients where to access skilled healthcare workers.

ICT can be used to combat HIV/AIDS, malaria and other diseases by making educational materials about prevention more readily available, faster and more frequent. This is happening with HIV Confidant in South Africa. SMS can be used to send out advice about contraception and family planning—as is the case with Text to Change in Uganda. ICTs are also being used to manage supply chains, train workers and track epidemic outbreaks (e.g., FrontlineSMS:Medic and Ushahidi in Malawi and Kenya, respectively). The data tracking capability will be especially useful in managing malarial outbreaks.
Landscape Analysis

In the landscape analysis section of this report, ICT-in-health interventions are identified and categorized. The interventions presented are occurring globally, on the African continent and in Ethiopia and Mali, the focus countries of this report. This section also highlights the potential ICT has to accelerate the ability of African nations to achieve MDGs 4, 5 and 6. The report uses Thailand as a benchmark given its strong health infrastructure and ICT networks, eLearning and telemedicine programs and medical tourism industry. Thailand has achieved these outcomes despite the fact that its GDP per capita has only grown from $2000 to $4600 since 1990.33

There is early evidence of ICT being used to address challenges that African countries face as they progress from Phase 2 and 3 to Phase 4 health system development. An example is the electronic health information systems (HIS) that Rwanda and Ethiopia are deploying on a national level. Likewise, there is evidence of the use of mobile interventions (mHealth) across the continent, where over 100 applications have been implemented for a variety of purposes including consultation, data exchange, referrals, supply chain management and training/education.34 For example, Child Count, an SMS-based application being used in Millennium Villages, allows community health workers to upload patient metrics to an external database, which is then monitored for irregularities.35 Francophone African countries such as Mali, Cote d’Ivoire, Senegal and Burkina-Faso have also implemented the RAFT, an online platform that allows for web-based seminars, trainings, discussions and sharing of best practices between healthcare professionals in each of the ten participating Francophone countries.36

This section highlights other innovations in eHealth and mHealth intervention across the continent.

Botswana has a small eLearning program for training health workers at the KITSO AIDS training center—a public-private partnership initiative between the Ministry of Health and Harvard Medical School. The government also committed in 2004 to Maitlamo, an e-health program in which ICT will be used “to facilitate the efficient delivery of healthcare to the population, provide information and education to the health community, and provide information to health administrators and managers.” The program would also establish an efficient and cost-effective healthcare system and ensure “…that the public can make informed choices about their lifestyle and healthcare” (Maitlamo, 2004).

Southern African countries have collaborated in the Building Europe-Africa Collaborative Network for Applying ICT in Healthcare Sector (BEANISH) project to develop the Health Information Systems Programs (HISP)/BEANISH system. HISP/BEANISH is an Open Source Java-based program that allows healthcare professionals to gather data and enter it into a digital healthcare system which can be used for data analysis and management. It is currently being used in Botswana, South Africa, Mozambique, Ethiopia, Malawi and Tanzania.37

The Gemalto program is exemplary in the application of ICT in Gabon. Gemalto creates e-Health cards to store an individual’s health records and insurance information. The cards can be used in hospitals, pharmacies and health
clinics, with measures in place to ensure the privacy and security of a patient’s data. The pilot project is currently being rolled out, with plans to take it nationwide in the near future.38

The Mobile Technology for Community Health (MoTeCH) Midwife initiative, conceived by the Grameen Foundation and funded by the Bill & Melinda Gates Foundation, uses mobile phone technologies to help Ghana achieve those goals.39 Using GPRS, SMS and IVR technologies, MoTeCH surveys midwives, allows them to dial in toll-free from other people’s phones, and empowers them to record and update critical data about pregnant mothers.40 One of the learning points expressed by a MoTeCH program director is that nearly everyone in the community has access to a mobile phone once the local mobile penetration approaches 33%. This is because midwives share mobile phones, as do pregnant women. This discovery indicates that information-based interventions can be executed before universal mobile phone ownership is reached.

Rwanda has decreased under-five child mortality by over 5% per year since 2003, more than halved its under-five child mortality since 1995 and dramatically increased HIV education.41 These advances were at least partly due to the implementation of a comprehensive national eHealth system (TraCNet, Open MRS, and National Health Information System). The system consists of programs for tracking patient records, monitoring infectious diseases, managing drug and supply chains, telemedicine communications with health professionals in distant areas and eLearning and training for healthcare workers.42

The Tunisian Society of Telemedicine and eHealth (Société Tunisienne de Télémédecine et de e-santé), an NGO comprised of doctors, telecom engineers and communications specialists, sponsors and promotes “visioconference.” Visioconference allows communication between health professionals in emergency cases. It also allows telediagnosis by professionals in hospitals at a distance. Between the country’s 13 tele-radiology centers, three tele-pathology, two tele-optomology, six regional hospitals, general hospitals, and six specialized centers, up to twenty sites can “visioconference” at any given time.43

An AED-SATELLIFE project, the Uganda Health Information Network (UHIN) uses PDAs to provide early warning information about the spread of communicable diseases. According to the literature, the data collection element is especially successful, being four times as efficient and 25% more cost effective than manual data entry.44 Mobile phones are also being used in Uganda in the Text to Change campaign, which seeks to increase knowledge and understanding of HIV/AIDS through SMS-based quizzes.45

Challenges and Opportunities for ICT

After presenting a landscape analysis of ICT in health across the African continent, this report then explores the challenges and the opportunities that arise for ICT use in the health sectors of African countries. It first summarizes challenges specific to the health sector (micro-level) and highlights the influence that persistent macro-level problems exert on health-sector challenges. It then considers the opportunity for ICT to assist in resolving micro-level challenges, keeping in mind that ICT interventions can only work if macro-challenges do not obstruct ICT capabilities.
The health sector in African countries transitioning from Phases 1 and 2 to phases 3 and 4 are challenged by, among others: 1) funding shortage, 2) equipment and supplies shortage, 3) insufficient quantity of skilled healthcare workers, 4) populations that are uneducated about prevention and treatment of preventable diseases, and 5) lack of health systems infrastructure that enable communication between rural and urban centers.

The shortage of funds is a primary barrier to providing and accessing affordable healthcare services in African countries. Despite the US$60 per capita recommended by WHO for universal coverage, the average healthcare expenditure in African countries was US$23 per capita in 2005, with African governments paying only 44% (US$10.12) of this amount. In fact, it is estimated that to achieve the Millennium Development Goals, more than 12% of GDP would need to be spent on health. In agreement, an IFC and McKinsey Consulting report (2007) estimates a US$25-$30 billion investment will be needed to meet demand for healthcare physical assets. According to the IFC report, the private sector (non-government sources) is already the recipient of over 50% of healthcare expenditure on the Continent, with 25% sourced from out-of-pocket expenditure. Fee-based funding of public health service models remain under scrutiny from analysts and development groups who cite the deleterious role that fee-based programs may play in increasing poverty. Of equal concern is over-dependence on external funding.

Various analysts, private equity groups and development agencies now encourage public-private partnerships and franchises as possible mechanisms that could balance, within the framework of the equity principle, the need to meet the demand for healthcare services, personnel and infrastructure with the promise of universal healthcare. Community health financing, micro-insurance and standard insurance programs are also seen as necessary components to the financing mix. The Institut Francais des Relations Internationals (IFRI) recommends ICT interventions to help resolve the challenges of promoting health insurance, overcoming the shortage of health personnel and improving the quality and density of infrastructure, but also warns against the belief that ICT can replace sustainable funding.

While the WHO has recommended currency, financial and telecom transaction levies as part of a package of potential solutions for the health systems development funding gap, a more mixed approach is most likely to bring success. For example, if the health and financial services sectors cooperate to develop innovative and mutually-beneficial business and financing models, ICT could enable consumer and institutional healthcare service delivery funded by out-of-pocket and insurance transactions. The potential benefit would make universal coverage possible for countries such as Rwanda, which allocates 19.5% of its total annual spending (or US$37 per capita) for basic service health insurance coverage.

In African countries, equipment and supply shortages have been associated significantly with the disparity in physical access to obstetric care. Without medical equipment and supplies it is difficult for health workers to provide the care they are capable of providing. Sometimes, supply shortages even lead to health center shutdowns. Telemedicine allows people living in remote areas to access the sophisticated equipment and expertise of urban areas. In South Africa, the MILLENSYS tele-radiology program allows rural hospitals to transmit radiological images via Internet connection from three rural hospitals to expert radiologists in Port Elizabeth and East London for diagnosis.

The African continent is home to nearly 25% of the global disease burden, yet has only 3% of the total global health workforce. Some estimates suggest the African continent has a shortage of 1.5 million healthcare workers. Unfortunately, research indicates that there is an inverse relationship between child and maternal mortality and the healthcare worker population. Severe personnel shortages affect many African countries, but some more than others. Ghana, Ethiopia and Uganda do not meet the 2 physicians per 10,000 minimum recommended by the WHO in 2009, but Botswana, Gabon, South Africa, and Tunisia do. Ethiopia, Mali and Rwanda don’t meet the 10 nurses per 10,000 minimum recommended by the WHO in 2009, but Tunisia, Botswana, Uganda and Ghana do. Mostly as a result of
training costs, underperforming countries find it less challenging to add traditional and community health workers than to increase the number of physicians and nurses. Brain drain has also exacerbated the skilled workforce issue in many countries. Over 40% of doctors—and many more nurses—born in each of twenty-five African countries work abroad. Nineteen percent of African-born doctors work abroad. The average for Sub-Saharan African countries is 28%.66

MDG 6 can be achieved only through a combination of medical approaches and public education campaigns. In Botswana, where there are significant HIV/AIDS-focused public health information campaigns in the forms of radio programs, television programs and information hotlines, the percentage of 15-24 year-old women with comprehensive and accurate knowledge of HIV/AIDS is about 40%. Those of Mali, Ethiopia and Gabon are lower at 18%, 20% and 24%, respectively. Because the HIV/AIDS prevalence in Mali, Ethiopia and Gabon are lower than that of Botswana, it is imperative these countries intensify their education programs to avoid regression. SMS-based mobile technology can be used as a cost-effective disseminator of health education information. This is being done in the Mobile Midwife program (MoTeCH) in Ghana67 which disseminates information about pregnancy and healthy child-rearing to expectant mothers through SMS.

African nations also do not have enough healthcare infrastructure—hospitals, health centers, hospital beds, back-up power sources, telecommunication networks and specialized equipment—that enable communication between rural and urban centers. The absence of these infrastructure elements increases the possibility of patient deaths due to “third delay” – i.e., the delay in receiving adequate service after reaching a healthcare facility. The impact is felt most by people in rural areas, where the deficiencies are more extreme. In Egypt, for example, the maternal mortality rate in the year 2000 was twice as high in the nomadic frontier regions, where few health facilities existed, as it was in the urban metropolitan centers (120 vs. 48 deaths per 100,000).68 Some countries, such as Gabon, South Africa and Uganda, have less than 1 hospital per 100,000 people, while Rwanda, Botswana, Tunisia and South Africa had 15-28 beds per 10,000 persons in 2009. By comparison, the United States had 34 beds per 10,000 people in the same year. Where the health system infrastructure is not complete, ICT can be used for digital data collection, as is the case with the OpenMRS69 system in Rwanda. SMS can be used for remote data collection, as is done in the EpiHandy program in Uganda, the Integrated Healthcare Information Services Through Mobiles (IHISM) system in Botswana and the Dokoza system in South Africa.70 Mobile, video and IVR solutions can also bridge the distance between urban and rural health service providers.

Though some of the challenges faced by the health sector in African countries are specific to the health sector (micro), other challenges are systemic (macro) over which the health sector has no control. ICT has the capability to turn these challenges into opportunities to reduce cost, increase productivity and, when appropriately applied, improve health. However, persistent macro-level challenges also increase barriers to using ICT to address health sector issues. Without addressing those macro-level challenges, implementation of ICT interventions becomes a challenge to health sector stakeholders. By resolving the macro-level issues, African leaders increase the probability that ICT will improve the efficiency, scalability and sustainability of health sector services.

Financial, human and intellectual capital constraints have reduced the ability of African countries to invest appropriately in healthcare and other sectors necessary to achieve MDGs 4, 5, and 6. External debt servicing, illicit financial flows (IFF) and the shadow economy are but a few of the challenges African countries have faced in their attempt at capital formation and accumulation over the last 30 years. Though the issue of debt is not as drastic as it once was—when eighteen African countries were servicing $40 billion in external debt—the impact of nearly 50 years of funds lost to servicing debts71 remains evident in these countries. Illicit financial flows (IFF), or funds taken or sent from a country illegally, are conservatively estimated to have grown from US$7.9 billion in 1990 to US$20.2 billion in
2008. Further, nearly two-thirds of African countries will have to consistently grow their economies at a pace greater than 6.2% per year just to meet their budgetary needs. Finally, a large shadow economy—legal economic activities whose revenues are not captured, recorded and taxed by governments—makes it difficult to plan and fund social services.

On a more positive note, some African countries have taken the renaissance of their financial capital into their own hands. A new breed of daring central bank governors are resurrecting the backbone of their financial systems—including re-instating and enforcing regulatory frameworks that meet international standards. They are also enabling these systems technologically with platforms that perform everything from ATM cash withdrawals to mobile money transactions. With a sovereign purpose, such countries as Ghana, Nigeria and Angola are tapping into the global capital markets to raise benchmark bonds that will allow them to replace external aid and continue developing their resources to provide adequate public services for their people.

At the heart of these sovereign efforts is the development of human capital—people who can add value to society. Though 70% of the African continent’s population (growing at nearly 3% annually) is rural and sustained by smallholder farming, the UN-HABITAT reports that the urban population in African countries is expected to triple to 1.23 billion between 2010 and 2050. A shift in African society from 60% rural to 60% urban within 40 years would mark the fastest rural population decline in the world. At particular risk of adverse impact from rapid urbanization are such countries as Ethiopia, Rwanda, Mali and Equatorial Guinea, each of which has rural populations in excess of 60%. These countries will have to extend infrastructure beyond the cities and build human capacity much more rapidly than such highly urbanized countries as Gabon, Tunisia, South Africa and Botswana, each of which has an urban population of more than 60%. They will have to retrain rural dwellers to use technology to their own benefit—for agriculture, trade, entrepreneurship, and personal wellness.

One key to developing human capital is educating youth under age 15, who comprise 45% of the rural population and will form the majority of the continent’s workforce within 10 to 15 years. If, however, neither educational nor employment opportunities are provided for the young people, the pace of urban migration in many countries could increase. Consequently, the absence of manpower from rural areas might jeopardize national food security, while rapid urbanization could lead to more poverty, crime and disease. If countries with large rural populations implement and fund policies that build capacity amongst the rural youth, they could turn the communities into centers of agricultural growth for food sovereignty that produce incremental opportunities for future generations.

At the same time, the absence of fully functioning technology transfer systems have made it difficult for countries to capitalize on latent intellectual capital. For example, few African countries have a strong research backbone that informs policy and aids the development of new products and services. Instead, many African countries sell valuable assets too early and cheaply due to the need to generate funds, thus compromising the future value of intellectual capital such as telecommunication frequency spectrum and rare pharmaceutical plants. A better intellectual capital agenda could accelerate revenue generation to facilitate critical public objectives like healthcare, food sovereignty and social security. However, such an agenda must be supported by a firm commitment to capacity and infrastructure development.

The World Bank spent nearly US$10 billion on capacity building in Africa from 1995-2004. In addition to the system, process, and resource improvements, special attention was paid to preparing the public workforce to provide public services to the people and the private sector. This was especially necessary as a market-based privatization strategy for the telecommunications, banking and energy sectors was advocated by multi-lateral aid organizations such as the World Bank, FMO (the Dutch development bank), and the International Monetary Fund. Yet organizational,
process and regulatory challenges continue to inhibit many African countries from achieving their social
developmental goals associated with the MDGs.

Processes have changed to meet expectations. Since 2001, the telecommunication industry has empowered end-users and investors on the African continent with availability and choice of service. This is not a small constituency: there are nearly 500 million mobile phone users in Africa, according to the International Telecommunication Union (ITU). This has changed the expectation for speed and quality of service in most African countries. Consumer demand has led to increased information flow, reduced arbitrage and more accountability for leaders, who must now meet international benchmarks, metrics and standards. Suddenly, a country’s business-friendliness could be assessed through websites and reports that calculate the number of days required to register a commercial enterprise in that country. In addition, an empowered electorate now demands similar service delivery from the public sector. However, many process constraints remain evident.

As part of the transition to democracy and deregulation, many African countries are fine-tuning and standardizing their regulatory systems to permit interoperability across regional economic communities. This is especially true for the telecommunications, oil and gas industries, which have been the focus of privatization programs during the last 10 years. Yet, policies and regulatory frameworks for the banking and power sectors are still incomplete or ineffectual in many countries, making it difficult for internal or external investors to fully participate. Further, policies and regulations that could stimulate technology transfer and innovation to guarantee food sovereignty and potential export have yet to receive due attention. Finally, there is a risk in some countries that regulatory barriers could delay cross-sector collaboration in strategic sectors such as finance and telecommunications. Such risks could spill over into the health sector, whose efficacy could depend on cross-sectorial collaborations and transactions.

The weak infrastructure base of African countries is a primary factor in their struggle to provide access to quality social services such as healthcare. According to the World Bank (2010), African countries would collectively require US$93 billion per annum over 10 years to build enough federal and municipal infrastructure in power, transportation (air, road, rail), water, information and communication technology (ICT) to achieve the Millennium Development Goals (MDGs) by 2015. Though mobile telecommunications coverage is quickly approaching 100% in every country, equal attention has yet to be paid to power, Internet, transportation and municipal services. Improved infrastructure could increase economic growth by 2 percentage points annually and would rejuvenate business productivity by up to 40%.

Case Studies

This report also highlights two countries—Ethiopia and Mali—as case study nations whose healthcare systems are still at the early, Phase 2, level of development, but who are utilizing ICT to increase healthcare access and quality of service to their populations. The report analyzes each nation within the framework established in the larger report and examines their micro and macro challenges. The case studies further investigate key eHealth interventions that have gained traction within each country. Through interviews and literature reviews, the report discusses the strengths of these programs and suggests how they can add value to the broader topic of eHealth interventions.

eHealth Strategy Development and Mainstreaming

Before offering recommendations, this report also discusses ways to develop strategy and mainstream eHealth interventions. The report concludes that the degree to which an eHealth service can be effectively established and provided is often dependent on the complexity of the system being implemented in relation to the enabling in-
country environment. Yet, for many countries, eHealth interventions are generally neither systematic nor fully strategic. Typically, there is a lack of emphasis on 1) creating an enabling environment, 2) amplifying collaboration between critical stakeholders, and 3) exploring effective combinations of interventions. The enabling environment includes scalable and appropriate infrastructure, transparent processes, fair legal frameworks, rules and standards for ICT component interoperability and incentivizing policies. Stakeholder collaborations involving end-users, government (cross-sector), civil society (including donors), private sector (industry) and researchers could accelerate understanding and success of interventions. And a well-designed mix of mHealth, telemedicine and eLearning could help a country create synergies and avoid redundancies. Thus, a holistic strategy that develops an enabling environment, facilitates the collaboration of stakeholders and properly designs the intervention mix is one in which an eHealth system would thrive. The resulting product would improve resource allocation, reduce delays to care, improve continuity of care, improve health worker skills and make ICT useful to health workers as a job tool for overcoming the micro and macro challenges discussed earlier.

When strategic intent is considered, the short list of high-performing countries is surprising. Of 114 countries surveyed by WHO in 2009, Botswana, Malaysia and Norway stand out as three countries that have not only developed national eGovernment, eHealth and telemedicine policies, but have also created national ICT procurement and multiculturalism policies for the health sector (including eHealth). This comprehensive strategy is something that many advanced nations, including the U.S., Canada and France, have not yet formulated. The overriding global trend is to establish a national eHealth policy and strategy that is independent of ICT initiatives in other sectors. Generally, the eHealth strategy focuses on 1) deploying a national health management information system (HMIS), 2) re-organizing health record keeping within the public-sector, 3) permitting public-sector deployments of telemedicine, eLearning and mHealth interventions, and 4) permitting public-private collaborations and private-sector providers to combine and leverage the national HMIS network with private communication infrastructure.

The rationale for establishing an HMIS foundation is that it enables countries to collect, organize, process and disseminate data while protecting individual identification and personalizing records and files. However, there is overwhelming anecdotal evidence in the developmental community that countries are neither realizing all these capabilities nor exploiting the full potential of their HMIS. In an attempt to guarantee universal healthcare for their residents, most countries have gravitated towards national health programs, some of which have significant eHealth components. The mix between the various components needed for a successful eHealth system have yet to be standardized.

This report offers a framework for the concepts of vertical focus and horizontal preparedness for the eHealth strategies countries develop and implement. Similar to the dials on a sound system equalizer, each eHealth
intervention category—mHealth, telemedicine, eLearning—occupies its own vertical axis upon which it can slide up or down. The level to which the intervention category slides up or down depends on its role within a country’s eHealth strategy. A country such as Ethiopia, for example, shows evidence of all three intervention categories at low levels as a result of its existing government broadband infrastructure. However, mHealth has assumed a more significant role based on its affordability, implementation speed and interest shown by both public- and private-sector participants who are working to improve maternal and child health. Ghana, appears to have placed mHealth at the center of their eHealth strategy with the Ghana Health Service (GHS) accentuating such projects as MoTeCH and the SENA PDA Project as early as 2004.84, 85, 86

The vertical focus can be heavily influenced by income level and funding source. As a result, many low-income Phase 1 and 2 nations that depend on donor funds focus on mHealth interventions partially because mobile networks increase penetration within their countries for a lower cost and partially because mHealth is a priority area for their donors. Uganda, Mali, Rwanda, Namibia and Chad are but a few countries that exemplify this trend.

This trend suggests that, because donors do not generally spend funds in low-income countries for projects that require capital-intensive broadband infrastructure, African countries that continue to depend on donor funds to develop eHealth interventions may be limited in terms of the kinds of interventions they can implement. The trend also suggests a need for regional pooling of infrastructure and financial and human resources that can collectively increase public access to a greater degree and mix of vertical interventions. This effort can be extended further with Community-based Health Financing (CHF)87 and, private investments and public-private partnerships, as Lesotho’s did with a $100 million, 425-bed hospital.88

Phase 4 and 5, upper-income nations such as Singapore, France, the United States and Australia, in contrast, have a greater choice of interventions because they control their funding sources. Those sources are both public and private, but more importantly they are derived from financial mechanisms such as health insurance, Medicare and social security that can reduce both individual and group financial risks.

There is a direct correlation between horizontal preparedness, the degree and mix of eHealth interventions, the quality of healthcare provision and the general wellness of residents. For one, the advancement and mix of eHealth interventions usually correlates directly with the advancement and cohesiveness of the country’s infrastructure, management information systems, identification schemes, and financial and human resources. This report provides a visual tool for conceptualizing vertical and horizontal components based on the maturity and mix of these attributes within a country. Attribute maturity also determines the degree and mix of eHealth interventions available within a country. Thus, many Phase 4 and 5, upper-income countries with greater horizontal preparedness—multiple financial pillars (domestic public- and private-sector donors and financiers) as well as the broadband infrastructure to support simultaneous development and deployment of interactive health system—tend to exhibit a greater degree and mix of eHealth interventions.

While 55% of countries surveyed by GOe have developed a national eHealth policy, few have established or implemented an eHealth strategy. However, Australia, Rwanda, Malaysia and Belize have been profiled extensively for their eHealth strategies that focus in particular on strengthened HMIS systems. So, the report discusses strengths and weaknesses of strategies of these countries.

The best eHealth strategies focus and standardize their systems to be:

- **Personalized**: The system should be individualized for patients and providers, using individual patient status and treatment history in care decisions
Ubiquitous: All patients should have access to their health information, even when accessing care from providers or facilities

Interoperable: All providers and systems should be able to interact and exchange information with each other

Interconnected: All stakeholders and systems should be interconnected and, to the extent possible, able to leverage the same infrastructure

Scalable: Systems should be able to expand functionally, in terms of the workers that use them and the populations they serve

Sustainable: Services and systems should be affordable without operating at a loss and should ideally result in efficiency gains to the health system

Secure: Personal data should be secure from external and internal misappropriation

Measurable: Service access, quality and impact should be measurable, as should adherence to the principles that govern the strategies

Viable and comprehensive eHealth strategies optimize existing processes—something that ICT, if properly implemented, can support. At the same time, it is important to note that simply overlaying ICT over already flawed processes and systems will not accomplish health sector goals and may result in waste and a loss of confidence in the ability of ICT to improve the system. For this reason, eHealth strategies and tactics that are implemented as part of a larger reform of national health systems and processes may have a greater chance of succeeding than those that are introduced as a standalone program.

The principles are supported by the 5 pillars of successful eHealth initiatives:

- Audit and Leverage National ICT Infrastructure
- Move toward Health Record and Personal Identification (ID)
- Optimize HIS Process
- Establish Guidelines for Developers
- Choose Appropriate Media

These pillars work hand-in-hand with the principles of an eHealth ecosystem. When developing strategy, policymakers also need to take into consideration the technological, financial, capacity and cultural dimensions of mainstreaming eHealth. The technological dimension considers three layers of the eHealth ecosystem (administrative, collaborative and applications layers), the players (or stakeholders) and the content that is exchanged between stakeholders and between layers. Within each layer are hardware and software considerations. The collaboration layer is also a significant element of the technological dimension. In the collaboration layer, national assets are made available to developers in the applications layer based on standards that establish competition and enable scaling and sustainability. The financial dimension includes considerations that make it possible to base funding decisions on an accurate understanding of the total cost of ownership (TCO) of a particular technology or system. The capacity dimension includes infrastructural and human resource considerations. The cultural dimension includes sociological considerations that may reflect the unique characteristics of each nation and its people.

The key conclusions, lessons and implications provided by this report are:

- **ICT-based interventions, across all sectors, succeed when** they match the needs and requirements of the stakeholders involved, when they can be supported by the technical, physical, and human infrastructure in which they are based, and because the underlying systems on which they are being overlaid are well-designed.
The most useful considerations are *not technology-related*. The nature of conversations about eHealth is often dominated by technology considerations, but failure to consider non-technology factors is often at the heart of intervention failures.

Mainstreaming is more important than radical changes. Mainstreaming eHealth, making ICT a fundamental part of delivering care and managing health systems, requires adherence to principles, an understanding of the dimensions involved in introducing ICT, and a recognition of the central pillars that support a comprehensive eHealth strategy.
Chapter 1: Introductory Review of ICT & Health

What is ICT in Health?

ICT (information and communications technology) is an umbrella term that encompasses any communication device, application or digital platform, including radio, television, cellular phones, computer and network hardware and software and satellite systems, as well as the various services associated with them, such as videoconferencing and distance learning. ICTs are often spoken of in the context of their service area, such as ICTs in education, healthcare or financial services.

Thus, ICT in the health sector, also called eHealth, is the use of information and communication technologies to enable, support and deliver health services to patients and populations. Mobile health, or mHealth, in which health services are enabled, supported and delivered with the help of mobile communication devices such as mobile phones and wirelessly-enabled PDAs, tablets and laptops, is one of three subsets of eHealth recognized by the World Health Organization. The other two are telemedicine and eLearning. All three have been deployed to some extent within African countries. For most of these countries, the backbone of their eHealth framework is some form of Health Management Information System (HMIS) or Health Information System (HIS).

Both the ICT 4 Development (ICT4D) and ICT and Development (ICTD) communities agree with the European Commission that the objective of eHealth is to improve the economics (i.e., reduce speed and costs while increasing scale, availability and reliability) associated with delivering health services to underserved populations in developing countries. While ICTD proponents are interested in using ICT for all aspects of development (including, for example, sports and entertainment), the ICT4D community’s purpose for ICT is to enable nations to achieve one or more of the eight United Nations’ Millennium Development Goals (MDGs).

According to a WHO Global Observatory for eHealth (GOe) survey, 83% of 112 surveyed countries identified at least one mHealth program, and 33% identified at least one telemedicine program within their country. Unsurprisingly, high-income countries, which have the most advanced enabling environment, are more likely to have fully established, institutional eHealth programs than are upper-middle, lower-middle and low-income countries. In contrast, the 31 African countries that responded to the survey and their lower-income counterparts were the least likely to have established, institutional programs in mHealth, telemedicine or eLearning. When these programs exist, they are in either the pilot or informal stages of development. Yet it is encouraging that over 67% of the 46 African countries that are WHO members responded to the survey—a response rate only slightly lower than South-East Asia (73%) and Europe (68%). This indicates a willingness and, perhaps, eagerness to “mainstream” eHealth as a cost-cutting and life-saving tool.

The State of Health Services as Justification for ICT for Health (eHealth)

UNICEF and WHO report that, over the last two decades, progress has been made by developing nations to meet their MDGs. For African countries, success has been varied. This section discusses the current state of healthcare on the African continent with a focus on the progress being made towards achieving MDGs 4, 5 and 6—those concerning the reduction of child mortality, improved maternal health, and progress on HIV/AIDS, and the reduction of malaria and other diseases, respectively. The objective is to establish a justification for developing and investing in technology based on evidence that ICT interventions can meet those needs and produce better and more efficient outcomes.
Phases of Progress of Health System Development

There is evidence that African countries are experiencing health system development challenges similar to those that nations in developed regions experienced during the nineteenth century. While there is no universally agreed categorization of the phases of health system development, there is ample literature that establishes a correlation between infant and maternal mortality, disease burden and economic growth to the maturity of the health system. Along this line, ICT use within healthcare systems seems to increase with certain variables that are more likely to exist in upper-income countries and less likely to exist in low-income countries. More specific indicators of ICT use include per capita Gross Domestic Product (GDP), per capita spending on health (as a percentage of GDP), health sector education, affordable health insurance, and private and public-private investments in the health sector.

Following is a five-phase framework for understanding the general progression of healthcare systems within a country and the conditions for the use ICT. The “phases”, illustrated in Figure 3, are determined by a review of the literature on the health and economic development of nations. While the first two phases are characterized by a society’s focus on behavioral changes, the middle and latter two phases make greater use of ICT to extend and improve interventions. The framework assumes a desire by the health sector stakeholders to enhance healthcare access and service quality to levels on par with upper-income countries. It is, then, possible that ICTs can facilitate and accelerate the transition from phase to phase.

- **Phase 1** is characterized by high infant and maternal mortality, low life expectancy (around age 30) and low economic growth. During this phase there is almost no evidence of the use of ICT for health development. This phase characterized African countries until the mid-twentieth century, while most industrialized countries moved out of this phase during the late-nineteenth century.

- **Phase 2** is characterized by a significant reduction in infant and maternal mortality, as well as an increase in life expectancy and economic growth. Improvements are driven by behavioral changes in lifestyle and habits of community members—often encouraged by the state in partnership with community leaders. For African countries in the mid-twentieth century, these included such basic changes as family planning, increased sanitation, water supply, education and access to basic preventative and curative healthcare. During this phase, there is early but limited evidence of the use of ICT for health development. Instead, the performance trends are facilitated by changes in government policy supplemented by increased availability of funding and supplies, support from the developmental community and a focus on community-based interventions. According to Bruce Fetter:

  “Africa’s mortality levels dropped significantly after the mid-twentieth century initially due to high amounts of aid from former colonial powers, the U.S., Scandinavia, the Eastern Bloc and UN agencies and relative prosperity of the continent, when government ministries began large scale health service programs including attempts to wipe out smallpox, diphtheria, typhoid, tetanus and yellow fever.” “...mortality rates continued to fall due to programs

![Figure 3: Five phases of health system development](image-url)
promoting personal hygiene like hand washing, increased access to potable water and vaccinations for diphtheria, whooping cough, tetanus, polio, diphtheria, measles and tuberculosis. In the 1980’s healthcare improvements declined and in some cases mortality rates began to increase with the onset of the HIV/AIDS epidemic, civil wars, famines and the ability of mosquitoes to build up immunities to common insecticides.  

- **Phase 3** is characterized by a further reduction in infant and maternal mortality, improving life expectancy and managed economic growth driven by systemic efforts which require more institutional inputs, including planning and financing, that align with the goals of individual and community initiatives established in Phase 2. As a result, the risk is greater in this phase for an increase in mismanagement and resource waste, bureaucratic delays and duplication of efforts due to the absence of an adequate information flow. Further, in this phase, there is a greater need for more advanced care such as Emergency Obstetric and Neonatal Care (EmONC) that requires technology to save time, money and lives.

- **Phase 4** is characterized by a continued reduction in infant and maternal mortality, drastically increased life expectancy and continued economic growth driven by results-oriented, ICT-enabled management systems. As the closest representative of the MDGs, this phase is the one in which many emerging market nations find themselves. It is therefore the near-term target for administrators of health systems in many African countries.

- **Phase 5** is characterized by a near elimination of infant and maternal mortality, extended life expectancy and a stable economy driven by established, results-oriented, ICT-dependent management systems. This phase is the one in which most industrialized countries exist and the one towards which emerging markets nations are moving. Childhood mortality is very low, easily preventable or curable diseases are no longer major killers and the leading causes of mortality are chronic or non-communicable diseases (e.g., hypertension, cancer, diabetes). This phase is the eventual target for most administrators of health systems in African countries.

This paper focuses on how ICT is being and can be utilized by African countries to move from Phases 2 and 3 to Phase 4 in the development of their health systems.

**A Decade of Progress with Much Left to Do**

**MDG 4: Reduce Child Mortality**

In 2010, UNICEF and WHO reported that child mortality and maternal death had both dropped by one-third since 1990. Both UNICEF and WHO also agree with independent experts that there is still much to do because, according to them “…22,000 children under five still die each day, with some 70 percent of these deaths occurring in the first year of the child’s life.” The *Levels & Trends In Child Mortality* report (UN IGME, 2010), illustrates the dire situation and notes that during two decades from 1990 to 2009:

- **Four million lives were saved, but not enough:** The global under-five mortality rate fell one-third from 89 to 60 deaths per 1,000 live births, meaning that the number of under-five child deaths declined from 12.4 million to 8.1 million during the same period. But though 12,000 more children under-five are saved each day, 22,000 others still die each day.
• **The rate of decline is too slow:** Though the rate of decline in under-five mortality accelerated during the period 2000-2009 compared to that of the 1990s, Sub-Saharan Africa, Southern Asia and Oceania were the only regions to not experience a reduction of at least 50%. This means that the rate of decline in these regions, in particular, is insufficient to achieve MDG 4. This contrasts with North Africa which, at an average of 40 deaths per 1,000 lives, will likely achieve its MDG 4 target.

• **Mortality is concentrated:** Under-five child mortality is 20 times (1 in 8) as severe in Sub-Saharan Africa as it is in OECD regions (1 in 167) and 1.75 times higher than in Southern Asia (1 in 14). Nigeria (10%) and India (21%) account for nearly one-third of the global under-five mortality cases, and Southern Asia and Sub-Saharan Africa combined account for 92%. The report noted that 40% of under-five deaths occur within the first 30 days of life and 70% occurs within the first 12 months. Finally, 18% of children died from pneumonia and 15% due to diarrheal diseases.98

Some African countries, such as Eritrea, Liberia, Ethiopia and Madagascar (4 of the world’s top-10 performers) reduced under-five deaths by 100 per 1,000 live births.99, 100 Northern African countries showed the most improvement with most of their under-five mortality figures falling at or below 40 per 1,000 live births.101 In contrast, others countries, such as Nigeria, whose mortality rate declined from 212 in 1990 to 138 in 2009,102 also have an annual rate of reduction of 2.13%, which falls short of the 4% annual reduction required to meet its MDG 4 target of 71 deaths per 1,000 live births.103

Furthermore, to account for the high level of underreported child deaths due to the large number of maternal deaths resulting from AIDS, mortality figures had to be adjusted upwards for 17 African countries with high HIV prevalence. Such was the case in Namibia, where under-five child mortality statistics had to be increased from 69 to 78 deaths between 2006 and 2009.104, 105 Others African countries, such as Botswana, continue to combat very high rates of HIV/AIDS, overshadowing their exemplary economic performance in which per capita GDP106 grew by over 7% per annum from 2005-2008.

**MDG 5: Improve Maternal Health**

The MDG Report indicates that a lack of skilled healthcare workers at the time of birth is a primary cause of maternal mortality. As a result, Northern African countries increased births attended by skilled professionals by 74% between 1990 and 2008. This contrasts with the trend in Sub-Saharan Africa, where less than half the births were attended by skilled healthcare workers. Part of the reason for the contrast is that, despite the 11% increase of women in rural Sub-Saharan African countries that received pre-natal care at least once during pregnancy since 1990, women in North African countries still receive pre-natal care at a rate twelve percentage points greater than those in Sub-Saharan Africa (78% vs. 66%).107 Ideally, women are encouraged to have at least four visits with a skilled healthcare worker while pregnant. Only 37% of rural women in Sub-Saharan Africa currently do that.

**MDG 6: Combat HIV/AIDS, Malaria and Other Diseases**

The African continent as a whole experienced an increase in HIV prevalence within the population between 2001 and 2009. Also, out of the 33.3 million people living with HIV worldwide in 2009, 69% of these lived on the African continent, meaning 22.5 million (2.25%) of Africa’s 1 billion inhabitants are infected by the virus.108 However, Sub-Saharan African countries experienced a decrease in HIV prevalence for adults between ages 15-49 between 2001 (5.9%) and 2009 (5.0%). Global decreases in HIV prevalence were driven by reductions in Africa; 22 out of 33
countries in which there was a 25% decline or stabilization in prevalence between 2001 and 2009 were African countries. These countries include Ethiopia, Nigeria, South Africa, Zambia and Zimbabwe. In fact, new infections amongst adults and children declined from 2.2 million to 1.8 million during the same period, indicating that interventions are yielding results.

Education about the dangers of HIV/AIDS and the need to use protection is the key to the progress that has been made. Namibia and Rwanda have shown a level of success educating people on HIV and prevention. In Rwanda, there was a 28% increase, between the year 2000 (23%) and 2007 (51%), in the number of young women that had comprehensive knowledge of HIV. The corresponding numbers for Namibia were 31% and 65%. Equally encouraging is the fact that more than 60% of the high-risk 15-24 year olds in Namibia, Burkina Faso and Cameroon now use condoms.

There were 225 million cases of malaria worldwide in 2009, and 765 million Africans are still at risk. African countries accounted for 91% of the nearly 781,000 malaria deaths in 2009 – 85% of which were children under five. From 1981 to 2009, malaria claimed at least 25 million African lives (an average of almost 1 million lives per year). Malaria remains at least as large a threat to the African continent as HIV/AIDS. The incidence rate continues to increase in Rwanda, São Tomé and Príncipe and Zambia, prompting the WHO to suggest a more vigilant disease monitoring and data collection system. Nonetheless, in Rwanda, the projected percentage of at-risk households owning at least one insecticide treated net (ITN) increased by 56 percentage points between the year 2000 (2%) and 2009 (58%). The corresponding numbers were 10% and 70% in Kenya; 3% and 57% in Madagascar; and 0% and 91% in Ethiopia. Regarding this trend, the WHO states, “There is evidence from São Tomé and Príncipe, Zanzibar and Zambia that large decreases in malaria cases and deaths have been mirrored by steep declines in all deaths among children less than five years of age, suggesting that intensive efforts at malaria control could help many African countries to reach, by 2015, a two-third reduction in child mortality as set forth in the MDGs.”

The Role of ICT Plays in Health Systems Development in African Countries

Why is ICT a Potential ‘Game-Changer’?

Given the various challenges still remaining to achieve MDGs 4, 5 and 6, many African countries, who are now in Phase 2 or 3 of their health system development, are in need of a ‘game-changer’— something that will significantly accelerate the gains they are making. The reward of a successful “push” is progression to Phase 4 and a better life for their people.

For most African countries, the consequence of an unsuccessful “push” is regression to Phase 2 and the difficulties of starting again, as well as the unacceptable cost of higher mortality rates for children and mothers. In fact, experts remain cautiously optimistic about the sustainability of the Phase 2 and 3 growth experienced by many African nations because these nations are still in the process of building political will, financial commitment, human capital and technology transfer, as well as the information, transaction, regulations and process infrastructure necessary to maintain the demand-driven momentum. These are all building blocks of development that, with ICT, could help a country to achieve sustainability in its health system improvement efforts.
As illustrated in Figure 4, ICT, properly integrated as a capacity-building enabler, enhances efficiency and improves system functioning. By empowering the health sector of a nation in Phase 2 and Phase 3 to increase communication and collaboration, focus on patients, reduce waste of financial and human resources and accelerate time, quality and frequency of service delivery, ICT has the potential to help nations enhance the results gained from behavioral changes established in Phase 2 and systems developed in Phase 3. The result would be a trajectory enabling these nations to achieve their MDG targets while establishing the foundation for a move to Phase 5 capabilities in the medium-term.

### Justifying the Substitutive Effect of ICT Expenditures

While technologists naturally see ICT as a solution to health system development, many policy-makers in resource-constrained countries acknowledge the myriad health system needs—medicines and supplies, human resources, physical infrastructure such as clinics and hospitals, ambulances—and ask whether ICT is a luxury. What is left out of this consideration is the role that ICT can play in accelerating a country’s transition from Phase 2 to 3 and then to Phase 4. Among other uses within such countries, ICT can be used to curb inefficient use of productive resources and address obstacles to providing affordable quality health services, thereby reducing child and maternal mortality, and combating HIV/AIDS, malaria and other diseases. Rather than depriving other areas of the health system of resources, investment in ICT serves to amplify the impact of those resources.

### Curb Inefficient Use of Productive Resources

ICT can be used to curb inefficient use of productive resources including financial, human and intellectual capital. In the report *Health Systems Financing: The Path to Universal Coverage* (WHO, 2010), Dr. Margaret Chan, Director-General of the WHO, suggests that “…20% to 40% of all health spending is currently wasted through inefficiency….” The report offers 10 points through which policy and practice could impact healthcare delivery. While the first three points involve the management of medicine, seven of the 10 points reference technology as a key consideration. In the view of the WHO, “Investing these resources more wisely can help countries move much closer to universal coverage without increasing spending.”

ICT can also be used to address the main obstacles to providing affordable quality healthcare in African countries. According to the literature, those obstacles include funding shortage, equipment and supplies shortage, insufficient quantity of skilled healthcare workers, populations that are uneducated about prevention and treatment of preventable diseases, lack of health system infrastructure and communication between urban and rural areas.

### Address Funding Shortage

The healthcare systems on the African continent need US$25-$30 billion in investment to fund 600,000 hospital beds; personnel including 90,000 physicians, 500,000 nurses and 300,000 community health workers; and retail and
distribution networks that can reliably deliver supplies and services.\textsuperscript{114, 115} There is an ongoing debate about the role the private sector and public-private partnerships\textsuperscript{116} can play in filling this funding gap,\textsuperscript{117} while policy-makers remain sensitive about the impact of fee-based funding and overdependence on external donor funding.\textsuperscript{118, 119, 120} Also, analysts stress the importance of including community health financing, micro-insurance and standard insurance programs in the financing mix. Finally, the \textit{Institut Francais des Relations Internationals} (IFRI) recommends the use of ICT to increase fiscal efficiency for hospitals but warns that cost control cannot replace sustainable funding.

With the impact that mobile-based ICT has already made for consumer communication and transactions, cooperation between the health and financial services sectors could yield mutually-beneficial business and financing models. These models could use ICT to enable consumer and institutional healthcare service delivery funded by out-of-pocket and insurance transactions. The potential benefit would make universal coverage possible for countries such as Rwanda, which allocates 19.5\% of its total annual spending (or US$37 per capita) for basic service health insurance coverage.\textsuperscript{121}

\textbf{Address Equipment and Supplies Shortages}

The supply chain issues that impede procurement and delivery of equipment and medical supplies is identified in literature as one of the top three points that could be improved to further develop health systems.\textsuperscript{122, 123} This issue can be addressed by a supply chain management and equipment tracking system\textsuperscript{124} in which mobile devices (phones, PDAs, tablets, laptops) are used for data collection and monitoring. With the appropriate device and application set, the cost of traditional data gathering and resource allocation could be greatly reduced.

\textbf{Address Insufficient Quantity of Skilled Healthcare Workers}

ICT can help fill the gap created by an insufficient quantity of skilled healthcare workers—a problem that is especially acute among Rural Health Extension Workers (RHEWs).\textsuperscript{125} By implementing SMS-based mobile and online training capabilities\textsuperscript{126} using municipal or private broadband infrastructure, it will be possible to share and promote best practices for and between health workers in African countries. The francophone RAFT network does a good job of this in Mali, Senegal, Cote d'Ivoire and Burkina-Faso.\textsuperscript{127}

\textbf{Address Populations that are Uneducated about Prevention and Treatment of Preventable Diseases}

ICT can help populations become better educated about prevention and treatment of preventable diseases. The 2010 MDGs report indicates a significant increase in knowledge about HIV across the continent. Disease prevention and treatment information can be disseminated through a variety of technology-based methods. Current programs use quizzes and information hotlines (Ethiopia), mobile phone SMS (Tanzania) and Interactive Voice Response (Ghana) systems. Further examples include Cell-Life and Project Masiluluke in South Africa, and Text to Change in Uganda.

\textbf{Address the Lack of Health System Infrastructure and Communication between Rural and Urban Centers}

ICT can help address the lack of health system infrastructure and communication between rural and urban centers. While many countries are increasing their physical assets in the form of additional clinics in rural areas, communication between rural healthcare extension workers (RHEWs) and trained nurses and doctors in peri-urban
facilities can occur through SMS, image delivery and video phone systems (e.g., TeleDermatology in Egypt\textsuperscript{128} and Ikon Tele-radiology in Mali).\textsuperscript{129} Information and metrics analysis solutions such as JavaROSA, being used in Kenya, South Africa, Tanzania, Uganda and Zambia, can also help resolve the issue.

**Reduce Under-five Child Mortality**

ICT can be used to reduce under-five child mortality by improving supply chain management to increase access to antibiotics, oral rehydration, vaccinations and mosquito nets. Also, mobile, SMS, IVR and video technologies can make it possible to administer short-term and mid-term training regimens for HEWs. These same technologies can be used to identify and resolve health issues, including epidemics, more proactively. Finally, databases, as part of modular and national HIS (health information systems) allow cross-analysis of patient information (e.g., child weight loss) to drive evidence-based decision-making at the individual, group, community and national levels.

**Reduce Maternal Mortality**

ICT can be used to reduce maternal mortality by making it possible to increase pre-natal consultation with professional healthcare workers and deliveries attended by skilled birth attendants. Mobile-based training and monitoring (e.g., MoTeCH in Ghana and RAFT in Senegal) will prove more valuable as GSM and CDMA networks and subscriptions penetrate rural areas, and even more so when mobile broadband services become a part of the national communication service offering. At that point, health extension workers will have access to nurses and doctors via phone, text message or video chat when problems arise. The infrastructure is already available in some countries, such as Ethiopia, which has a CDMA 450MHz network that covers 90\% of their rural population with at least one community phone in 15,000 of 18,000 kebeles (communities). These technologies result in more efficient data collection. In Uganda, for instance, the Ugandan Health Information Network experienced a 25\% cost savings in the first 6 months as a result of the ability to use ICTs to inform patients where to access skilled healthcare workers.\textsuperscript{130}

**Combat HIV/AIDS, Malaria and Other Diseases**

ICT can be used to combat HIV/AIDS, malaria and other diseases by making educational materials about prevention more readily available, faster and more frequent. This is happening with HIV Confidant in South Africa. SMS can be used to send out advice about contraception and family planning—as is the case with Text to Change in Uganda. ICTs are also being used to manage supply chains, train workers and track epidemic outbreaks (e.g., FrontlineSMS:Medic\textsuperscript{131} and Ushahidi\textsuperscript{132} in Malawi and Kenya, respectively). Data tracking capabilities will be especially useful in managing malarial outbreaks.\textsuperscript{133}
Chapter 2: Landscape Analysis of ICT Interventions in the Health Sector

Chapter 1 focused on the potential for ICT to transform the health sector – the “why” behind investing in ICT for health. As was mentioned at the beginning of that chapter, ICT in the health sector, also called electronic health, or eHealth, is the use of information and communication technology (ICT)—such as computers, mobile phones, satellites, applications, information systems and digital platforms—to enable, support and deliver health services to patients and populations.134 Mobile health, or mHealth, is a subset of eHealth in which health services are enabled, supported and delivered with the help of mobile communication devices such as mobile phones and wirelessly-enabled PDAs, tablets and laptops.135

In this chapter, in the landscape analysis section of this report, ICT-in-health interventions are identified and categorized. The interventions presented are occurring globally, on the African continent and in Ethiopia and Mali, the focus countries of this report. This section also highlights the potential ICT has to accelerate the ability of African nations to achieve MDGs 4, 5 and 6. This chapter leads into the following chapters, which explore opportunities and challenges to establishing, scaling and sustaining ICT in Health, present case studies and offer recommendations to policy-makers and administrators in African countries, their development partners and the private sector for sustainable, scalable and successful interventions.

Figure 5: Comparative analysis of under-five child mortality (per 1,000). Source: World Bank Development Indicators
ICT in Health (Global)

This section highlights eHealth and mHealth use globally, but more specifically in non-African nations, where low-income countries are using ICT to move their health systems from Phases 2 and 3 to Phase 4, middle-income nations are progressing from Phase 4 to Phase 5, and industrialized countries are using ICT to control costs and improve efficiency while maintaining strong outcomes. Many countries are initiating Electronic Health Records (EHR) systems, Health Information Systems (HIS) and mHealth interventions to improve communications regarding referrals, prescriptions and individual health records. However, for Australia and some OECD countries, issues such as proportional return on investment (ROI) and interoperability of EHR systems have been the biggest concerns over the last half decade.136, 137 In some places, obsolete legacy technologies and systems have become a burden where they were once an advantage. Meanwhile, developing countries that are less constrained by legacy technology systems are taking advantage of their high mobile subscription rates to introduce mHealth interventions with the potential to leapfrog older systems. In the following section, a special focus is placed on Southern Asia because of its similarity to Africa in health system improvement objectives and HIV disease burden. Thailand stands out within that region as an extraordinary performer.

Thailand

Thailand is highlighted as a benchmark in Southern Asia due to the strides it has made establishing a health infrastructure and information network, developing an eLearning and telemedicine program and nurturing a successful medical tourism industry over the last few years. Aside from adopting and pursuing a universal healthcare structure, Thailand has made eHealth an important piece of its health policy structure.138 The results are compelling. Figures 5 and 6 illustrate that Thailand’s under-five child mortality rate was already below the MDG target of 31 in 1990, despite a per capita GDP of less than US$2,000. In contrast, neither Botswana’s nor South Africa’s under-five child mortality rate meets the MDG target despite the fact that their 2009 per capita GDP is approximately 50% higher than that of Thailand. These figures speak to the impact of HIV/AIDS on the populations of Botswana and South Africa, both prosperous nations relative to the rest of the African continent. In Botswana, 496,000 of 2 million people are infected with HIV, while in South Africa 5.6 million139 of 49 million people are infected.140 However, the statistics also highlight the discipline and success of Thailand’s health system development.
Thailand’s healthcare system is characterized by highly-trained and educated doctors and excellent private hospitals, and it is commonly ranked as a leading destination for medical tourism due to the low cost of reliable medical care, as well as an advanced electronic medical record (EMR) system at nearly all hospitals and clinics. Administrative data sharing is more common than clinical data sharing, which is still often recorded on paper. The system has private tele-radiology services with a similar pilot system being tested for public services. mHealth is also present, with PDAs being used for collecting community and clinical health data, delivery of healthcare information to practitioners, researchers and patients, real-time monitoring of patient vital signs and direct provision of care. The Mekong Basin Disease Surveillance System – a piloted mHealth project using mobile phones for disease surveillance and management of emergencies and disasters (GeoChat SMS groups) – is being developed in cooperation with other countries in the region. eLearning facilities provide continuous education to health professionals and training for health science students. HIV prevalence is currently 1.4%, although with a population of over 65 million, its 530,000 HIV cases outnumber those of even a high-prevalence country like Botswana. The country enjoys 92 mobile subscriptions per 100 people, and the advanced state of the telecommunications infrastructure could become a major contributor to efforts to control the spread of HIV.

**ICT in Health (Africa)**

**Early Signs of ICT Use in African Countries**

There is early evidence of ICT being used to address challenges that African countries face as they progress from Phase 2 and 3 to Phase 4 health system development. An example is the electronic health information systems (HIS) that Rwanda and Ethiopia are deploying on a national level. Likewise, there is evidence of the use of mobile interventions (mHealth) across the continent, where over 100 applications have been implemented for a variety of purposes including consultation, data exchange, referrals, supply chain management and training/education. For example, Child Count, an SMS-based application being used in Millennium Villages, allows community health workers to upload patient metrics to an external database, which is then monitored for irregularities. Francophone African countries such as Mali, Cote d’Ivoire, Senegal and Burkina-Faso have also implemented the RAFT, an online platform that allows for web-based seminars, trainings, discussions and sharing of best practices between healthcare professionals in each of the ten participating Francophone countries. This section highlights other innovations in eHealth and mHealth intervention across the continent.

**Botswana**

Botswana has a small eLearning program for training health workers at the KITSO AIDS training center—a public-private partnership initiative between the Ministry of Health and Harvard Medical School. The government also committed in 2004 to *Maitlamo*, an e-health program in which ICT will be used “to facilitate the efficient delivery of healthcare to the population, provide information and education to the health community, and provide information to health administrators and managers.” The program would also establish an efficient and cost-effective healthcare system and ensure “…that the public can make informed choices about their lifestyle and healthcare” (*Maitlamo* 2004).

Despite its per capita GDP of over US$6,000, Botswana’s economy is hamstrung by an HIV prevalence rate of 24.8%—one of the highest in the world. To combat this, the government mandated that healthcare facilities must be located within 15km of all individuals. All hospitals now participate in the ARV program and are equipped with computers that will be fully utilized once all hospitals are networked. The system includes a data collection and public
information distribution application (IHISM), though the system is hindered by the lack of standards for data
collection. There are radio shows such as Makgabaneng and Health Chat that educate people about HIV, even letting
listeners use SMS to answer questions during the programming. An integrated patient management system for patient
records is currently in the pilot phase and, once it is operational, it will be able to capitalize on the 77% mobile
 cellular subscription rate.

**Southern Africa**

Southern African countries have collaborated in the Building Europe-Africa collaborative Network for applying IST
in Healthcare sector (BEANISH) to develop the Health Information Systems Programs (HISP)/BEANISH system.
HISP/BEANISH is an Open Source Java-based program that allows healthcare professionals to gather data and enter
it into a digital healthcare system which can be used for data analysis and management. It is currently being used in
Botswana, South Africa, Mozambique, Ethiopia, Malawi and Tanzania. As it is written on an Open Source
platform, African programmers can continue to develop and alter the program for their own needs as they arise.
Additionally, BEANISH developers seek to increase the number of post-graduate programs to encourage further
research and development of the system. It was started as a pilot in Botswana in 2005, and is being scaled up
nationally with plans to replicate in Ethiopia and to create standards across countries.

**Gabon**

The Gemalto program is exemplary in the application of ICT in Gabon. Gemalto creates e-Health cards to store an
individual’s health records and insurance information. The cards can be used in hospitals, pharmacies and health
clinics, with measures in place to ensure the privacy and security of a patient’s data. The pilot project is currently
being rolled out, with plans to take it nationwide in the near future. Gemalto was selected by the national healthcare
body as part of President El Hadj Omar Bongo Ondimba’s plan to modernize the healthcare system.

**Ghana**

In Ghana, the Mobile Technology for Community Health (MoTeCH) Midwife initiative, conceived by the Grameen
Foundation and funded by the Bill & Melinda Gates Foundation, uses mobile phone technologies to help Ghana
promote and provide health services. Using GPRS, SMS and IVR (Interactive Voice Response) technologies,
MoTeCH surveys midwives, allows them to dial in toll-free from other people’s phones, and empowers them to
record and update critical data about pregnant mothers. One of the learning points expressed by a MoTeCH
program director is that nearly everyone in the community has access to a mobile phone once the local mobile
penetration approaches 33%. This is because midwives share mobile phones, as do pregnant women. This discovery
indicates that information-based interventions can be executed before universal mobile phone ownership is reached.

**Rwanda**

Rwanda’s health sector has benefited from strong political leadership and comparatively heavy investment. The
country has decreased under-five child mortality by over 5% per year since 2003, more than halved its under-five
child mortality since 1995 and dramatically increased HIV education. Health officials, in collaboration with
a number of donors, have rolled out a comprehensive national eHealth system (TraCNet, Open MRS, and National
Health Information System) consisting of programs for tracking patient records, monitoring infectious diseases,
managing drug and supply chains, communicating with health professionals in distant areas and eLearning and training for healthcare workers.149

**Tunisia**

Much like Thailand, Tunisia has successfully developed a sophisticated and professional healthcare system. As a result, life expectancy is 76, only two years below that of the United States (78). Under-five child mortality is 20.7 per 1000, which is 2.5 times that of the U.S. but well below the Millennium Development Goal of 40 per 1000 live births. Like Thailand, Tunisia is also becoming a popular destination for medical tourism, as it offers a sophisticated medical care at a low price.

There are several notable eHealth initiatives in Tunisia. For example, the Tunisian Society of Telemedicine and eHealth (Société Tunisienne de Télémédecine et de e-santé), an NGO comprised of doctors, telecom engineers and communications specialists, sponsors and promotes “visioconference.” Visioconference allows communication between health professionals in emergency cases. It also allows telediagnosis by professionals in hospitals at a distance. Between the country’s 13 tele-radiology centers, three tele-pathology, two tele-optomology, six regional hospitals, general hospitals, and six specialized centers, up to twenty sites can “visioconference” at any given time.150

**Uganda**

An AED-SATELLIFE project, the Uganda Health Information Network (UHIN) uses PDAs to provide early warning information about the spread of communicable diseases. According to the literature, the data collection element is especially successful, being four times as efficient and 25% more cost effective than manual data entry.151 Mobile phones are also being used in Uganda in the Text to Change campaign, which seeks to increase knowledge and understanding of HIV/AIDS through SMS based quizzes.152 AED-SATELLIFE has implemented a similar program in Mozambique (MHIN). These programs are complemented by an alerting and reporting platform (GATHERdata) that turns data collected on mobiles into useful information,153 as well as a content management (GUIDE) system that formats health documents for PDAs.154

**ICT in Health (Ethiopia and Mali)**

Ethiopia and Mali are the country case studies being covered in this report. This section pertains to eHealth and mHealth activities in these two countries. A later chapter will explore national-scale efforts in these two countries to create a comprehensive program for eHealth and mHealth.

**Ethiopia**

Five ICT-related health programs and initiatives stand out in Ethiopia, contributing to an improved healthcare landscape. With cellular subscription rates exceeding 10% in 2011, there is greater possibility for ICT interventions to contribute to further improvements.

- **EpiSurveyor:** DataDyne and John Snow Inc. (JSI) partnered to use EpiSurveyor in a number of contexts to allow field researchers to collect critical data. JSI executes EpiSurveyor projects through Last 10 Kilometers (L10K), a non-profit organization aimed at improving the reach of the health system into rural communities. According to JSI, the project “mobiliz(es) families and communities to more fully engage to
improve household and community health practices and ultimately improve key reproductive, maternal, neonatal and child health outcomes.”  The organization has found success in using EpiSurveyor to implement various data collection initiatives in over 100 woredas (communities).

- **Fitun Warmline (AIDS Hotline):** Fitun is a free hotline that provides healthcare professionals answers to their questions about HIV/AIDS care and treatment. While access to antiretroviral treatment (ART) has significantly improved in recent years, especially in remote areas of Ethiopia, there is still a shortage of experienced HIV-care providers. Since May 2008, the free hotline has made it easier for professionals to find information.

- **HealthNet Ethiopia:** Working in partnership with SATELLIFE, HealthNet Ethiopia has been able to develop a communication network for health professionals throughout Ethiopia. There are currently 62 access points across the country, including hospitals, medical schools, non-governmental organizations (NGOs), clinics, health research centers and private health professionals at their homes or workplaces. As a result of HealthNet Ethiopia, The Gondar College of Medical Sciences and the Jimma Institute of Health Sciences located in the northern and western parts of the country, respectively, have a total of 3000 faculty and students who depend on HealthNet Ethiopia for their electronic communication and information searches. Many of these advances are made possible by the extensive telecommunication infrastructure and eGovernment program that Ethiopia has developed since 2006.

- **RapidSMS:** RapidSMS is a mobile SMS application designed to monitor, analyze and customize field reports while enabling SMS messages between field monitors. In October 2008, Ethiopia experienced crippling droughts. Faced with the possibility of famine, UNICEF Ethiopia launched a massive food distribution program to supply the high-protein food Plumpy’nut to under-nourished children at more than 1,800 feeding centers in the country. Previously, UNICEF monitored the distribution of food by deploying a small number of individuals to each feeding center. The monitor wrote down the amount of food that was received and distributed, and whether more food was needed. With the manual system, there had been a two-week to two-month delay between the collection of data and analysis. In a famine situation, each day can mean the difference between recovery, starvation, or even death. The Ethiopian implementation of RapidSMS as a supply chain tool eliminated the delay.
Wegen AIDS Talkline: Wegen AIDS Talkline is a toll-free hotline that provides information, telephone counseling and a referral service on HIV/AIDS, sexually transmitted illnesses and TB-related topics, all anonymously. The hotline has language-specific counseling available in 14 local languages. Since its inception in 2004, calls received by the hotline have multiplied three-fold, with over one million calls received in 2009. Most Ethiopians who use the line do so with their mobile phones, signaling receptiveness to the idea of receiving health-related information through this channel.

Mali

Three programs stand out in Mali:

- **RAFT:** The RAFT program is an online platform that allows for online seminars, trainings, discussions and sharing of best practices between healthcare professionals in each of the ten participating Francophone countries, including Mali, Cote d'Ivoire, Senegal and Burkina Faso.

- **Pesinet:** Pesinet seeks to reduce child mortality through frequent monitoring of children under five. Healthcare workers meet with each child once per week to take vital statistics and look for symptoms of generic diseases, collect data via mobile devices and send them to a central database, which flags any abnormalities. Patients who have been flagged are given an emergency ticket and told to go see a doctor at the nearest Community Health Center. A pilot program has been in effect in district III of Bamako since early 2010 as a joint effort between Pesinet, the Ministry of Health and several foundations including Orange Mali Foundation and BICIM, a local subsidiary of the European banking and financial group BNP Paribas.

- **IKON Tele-radiology:** IKON Tele-radiology is a project designed to allow health centers in rural areas gain the support and expertise of larger hospitals in cities through Internet and telecommunication media. Healthcare workers in regional hospitals transmit radio scans to trained radiologists in the capital of Bamako, who can analyze and diagnose the images. The project is managed by a local NGO (*Société Malienne d’Imagerie Médicale*) with some help from IICD. It has been in operation since 2005.

Figure 6: Comparative analysis of Mali’s health indicators against mobile cellular subscriptions
Chapter 3: Challenges and Opportunities for ICT in the African Health Sector

Chapter 3 explores the challenges and the opportunities that arise for ICT use in the health sectors of African countries. Using such tools as Table 1, this chapter summarizes those challenges specific to the health sector and highlights the influence that persistent macro-level challenges have on the likelihood of the micro-level challenges being resolved. It then considers the opportunity for ICT to assist in resolving micro-level challenges, while asserting that ICT interventions can only work if macro-challenges do not obstruct ICT capabilities.

Systemic (macro-level) challenges faced by leaders in African countries are substantial and complex, and have a significant impact on health sector (micro-level) service providers. National challenges like inadequate financial capital, capacity building and infrastructure availability make it difficult for leaders to plan and meet the needs of citizens, particularly when Information and Communication Technology (ICT) interventions are being considered.

Persistent macro-level challenges could render some African countries incapable of establishing, scaling and sustaining health sector interventions. According to a WHO officer in Ethiopia and consultants in Mali, systemic constraints often impede the progress of potentially useful health projects as unmet sector-specific needs accumulate year over year.

Table 1: Health sector challenges and the macro-level influencers that obstruct interventions

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<th>Health Sector (micro-level) Challenges</th>
<th>Systemic (macro-level) Challenges</th>
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<td>Capital Constraints</td>
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<td>Funding Shortage</td>
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<td>Equipment and Supplies Shortage</td>
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<td>Insufficient Quantity of Skilled Healthcare Workers</td>
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<td>Population Uneducated About Prevention and Treatment of Preventable Diseases</td>
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<td>Lack of Health Infrastructure to Enable Communication Between Rural and Urban Centers</td>
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Health Sector Challenges and Macro-level Influencers

The health sector in African countries transitioning from phases 1 and 2 to phases 3 and 4 are challenged by, among others: 1) funding shortage; 2) equipment and supplies shortage; 3) insufficient quantity of skilled healthcare workers; 4) populations that are uneducated about prevention and treatment of preventable diseases; and 5) lack of health systems infrastructure that enable communication between rural and urban centers. The following sections use Table 2 as a tool to discuss the challenges featured in Table 1 with reference to their micro-level influencers and opportunities for ICT interventions.

Table 2: ICT intervention methods and the macro-level influencers that obstruct their implementation

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<tr>
<th>ICT Interventions Method</th>
<th>Systemic (macro-level) Challenges</th>
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<td>Capital Constraints</td>
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<td>1 Digital Health Ecosystem (DHE)</td>
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<td>2 SMS</td>
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<td>3 IVR</td>
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</tr>
<tr>
<td>4 Video (telemedicine)</td>
<td>X</td>
</tr>
<tr>
<td>5 Radio</td>
<td>X</td>
</tr>
<tr>
<td>6 TV</td>
<td>X</td>
</tr>
<tr>
<td>7 HMIS</td>
<td>X</td>
</tr>
</tbody>
</table>

Funding Shortage

While the African continent bears 22% of the global disease burden and nearly a million people dying of preventable malaria each year, it claims only 1% of the world’s expenditure on health. The shortage of funds is a primary barrier to providing and accessing affordable healthcare services in African countries. Despite the US$60 per capita recommended by WHO for universal coverage, the average healthcare expenditure in African countries was US$23 per capita in 2005, with African governments paying only 44% (US$10.12) of this amount. In fact, it is estimated that to achieve the Millennium Development Goals, more than 12% of GDP would need to be spent on health. This would be a significant challenge even for relatively prosperous countries like Botswana and South Africa, which already spend 10.3% and 8.2% of their GDP on healthcare (or US$612 and US$485 per capita), respectively.

An IFC and McKinsey Consulting report (2007) estimated a US$25-$30 billion investment will be needed to meet demand for healthcare physical assets, including over 600,000 hospital beds; personnel including 90,000 physicians, 500,000 nurses and 300,000 community health workers; and retail and distribution network that will guarantee...
The delivery of supplies and services. According to the IFC report, the private sector (non-government sources) is already the recipient of over 50% of healthcare expenditure on the Continent. Sixty-percent of the $16.7 billion African residents spent on healthcare services in 2005 was out-of-pocket expenditure, while 25% came from external donors. With this volume expected to increase with private investments, fee-based funding of public health service models remain under scrutiny from analysts and development groups who cite research that warn against the harmful role that fee-based programs could play in increasing poverty among African populations. As well, some analysts argue that it would be better to enable domestic institutions to meet local financing needs than to assume more external funding.

Based on the above, various analysts, private equity groups and development agencies encourage public-private partnerships and franchises as possible mechanisms that could balance, within the framework of the equity principle, the need to meet the demand for healthcare services, personnel and infrastructure with the promise of universal healthcare. Community health financing, micro-insurance and standard insurance programs are also seen as necessary components of the financing mix.

While investments can address funding inflows, inefficient spending in hospitals also needs to be controlled. A study by the WHO indicates that hospitals in African countries could more than double their outputs with the same number of inputs if they used resources more efficiently. And a recent publication by the Institut Francais des Relations Internationals (IFRI) states that, “More and more projects are [also] mobilizing information technology and communication technology (ICT) in the area of health in Africa. ICTs can respond, at least in part, to three major challenges for health in Africa: promoting health insurance, overcoming the shortage of health personnel and improving the quality and density of infrastructure related to general health.” The same study warns, however, “even if results in these areas are promising, the development of these projects is hampered by the lack of sustainable funding.”

Figure 7: Some African countries with top per capita health expenditure (USD) in 2009.

Botswana, Gabon, South Africa, and Tunisia have spent significantly more than the recommended US$60 per capita on health issues. Botswana’s commitment is evidenced by the additional fact that, at 10.3%, they lead four other African countries that spend more than 8% of their GDP on the health sector. Those countries are Rwanda (9.0%), South Africa (8.5%), Uganda (8.2%), and Ghana (8.1%). The fact that a per capita spend of US$612 has helped reduce the growth rate of new HIV/AIDS cases in Botswana is a testament to the significance of adequate funding to curbing preventable diseases and achieving the MDGs.

Opportunity for ICT: While Table 3 (below) highlights opportunities for ICT interventions, it also indicates that such interventions cannot be realized without adequate infrastructure and committed leadership. Provided these conditions exist, mobile technology can facilitate new business and service models to help alleviate the funding challenge on the consumption and provision side. For example, Changamka offers an application that allows Kenyans...
to purchase “Smart Cards” on which they can save money for healthcare in small increments via mobile phone or refill station and use them for hospital or doctor visits, medication or lab consultations.

Mobile-based ICT has already made it possible to meet consumer communication (voice) and transaction (remittance) demand and thus increase national and regional revenues with a visible multiplier effect. After an unweighted 49-country study indicated US$60 as the per-capita funding needed in 2015 to achieve universal health coverage, the WHO recommended currency, financial and telecom transaction levies as part of a package of potential solutions for the health systems development funding gap.\textsuperscript{178} With global remittances nearing US$550 billion in 2008 (potentially exceeding US$1 trillion if mobile remittances are eventually globalized\textsuperscript{179}), the global post-paid mobile market at over US$750 billion\textsuperscript{180} and mobile money transactions through platforms such as M-PESA totaling US$148 million a year,\textsuperscript{181} the windfall from such levies would be substantial. If the health and financial services sectors cooperate to develop innovative and mutually-beneficial business and financing models, ICT could also enable consumer and institutional healthcare service delivery funded by out-of-pocket and insurance transactions.
### Table 3: Short-term and long-term approaches to overcoming the impact of macro-level influencers on health sector and ICT interventions

<table>
<thead>
<tr>
<th>Health Sector (Micro-level) Challenge</th>
<th>System-wide (Macro-level) Influencer</th>
<th>Impact on Citizens</th>
<th>ICT Opportunity</th>
<th>ICT Challenge</th>
<th>Path to Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding Shortage</td>
<td>Relatively high cost to provide civil services</td>
<td>Reduced confidence in leaders’ ability to deliver public services</td>
<td>Reduce costs (mHealth/telemedicine)/increase cross-sector revenues with ICT platform (telco/mMoney)</td>
<td>Insufficient infrastructure (telecom/power)</td>
<td>0.5-1YR: low-cost, preventive interventions; reprioritize health funding in policies and budget</td>
</tr>
<tr>
<td></td>
<td>Limited revenue sources</td>
<td>Residual impact on quality of life</td>
<td>Fund health with ICT-assisted savings/revenues</td>
<td>Existing intellectual assets (spectrum) not maximized</td>
<td>1-5YRS: resolve ICT challenges; Commitment of leadership</td>
</tr>
<tr>
<td></td>
<td>Health deprivatized</td>
<td>High mortality</td>
<td></td>
<td>No cross-sectoral collaboration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of economic productivity</td>
<td></td>
<td>Commitment of leadership</td>
<td></td>
</tr>
<tr>
<td>Equipment and Supplies Shortage</td>
<td>Funding shortage</td>
<td>Service gaps</td>
<td>Deploy real-time ICT to enable 1) urban-rural communication (telemedicine) and 2) mobile-assisted supply chain management (MASCIN)</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: target rural providers for low-capacity (mobile) supply chain interventions</td>
</tr>
<tr>
<td></td>
<td>Limited access between urban and rural areas</td>
<td>More deaths related to “multiple delays”</td>
<td>Increase training cost and increase penetration with ICT (broadband, video/IVR/SMS)</td>
<td>Device interoperability</td>
<td>1-5YRS: increase rural connectivity, roads transportation; higher-capacity database systems</td>
</tr>
<tr>
<td></td>
<td>Inefficient manual supply chain management (SCM) processes</td>
<td>Reduced trust levels</td>
<td>Increase rural access to specialized care training with ICT (telemedicine)</td>
<td>Inefficient supply chain process (done by hand)</td>
<td></td>
</tr>
<tr>
<td>Insufficient Quantity of Skilled Healthcare Workers</td>
<td>Underfunded skilled education system</td>
<td>Increase in “third delay”-related mortality</td>
<td>Reduce training cost and increase penetration with ICT (broadband, video/IVR/SMS)</td>
<td>Commitment of leadership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High unemployment</td>
<td>Spread of communicable diseases</td>
<td>Increase rural access to specialized care training with ICT (telemedicine)</td>
<td>Low rural connectivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Brain drain”</td>
<td>Loss of economic productivity due to third delay</td>
<td></td>
<td>Device and service usability for healthcare workers</td>
<td></td>
</tr>
<tr>
<td>Population Uneducated About Prevention and Treatment of Preventable Diseases</td>
<td>Underfunded primary and secondary education system</td>
<td>Increase in “third delay”-related mortality</td>
<td>Increase rural access to specialized care training with ICT (telemedicine)</td>
<td>No proven scalable and sustainable business model</td>
<td>0.5-1YR: video broadband group training at urban and rural health centers; low-cost mobile continuing education</td>
</tr>
<tr>
<td></td>
<td>Sociocultural norms that encourage misunderstanding of communicable diseases and unhealthy behaviors</td>
<td>Spread of communicable diseases</td>
<td></td>
<td>Commitment of leadership</td>
<td>1-5YRS: increase rural connectivity; improve education system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of economic productivity due to third delay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of Health System Infrastructure to Enable Communication Between Rural and Urban Centers</td>
<td>Underfunded primary and secondary education system</td>
<td>Avoidable high rates of transmission and mortality due to preventable diseases</td>
<td>Radio, TV, and mobile education campaigns promoting disease prevention and healthy living</td>
<td>Literacy of rural populace</td>
<td>0.5-1YR: maximize telecom networks for SMS/voice/video training</td>
</tr>
<tr>
<td></td>
<td>Lack of financial capital to develop and maintain healthcare system</td>
<td>Spread of epidemics</td>
<td>Patient reminders improve timing and quality of treatment</td>
<td>Mobile phone ownership</td>
<td>1-5YRS: improve mobile and broadband connectivity; increase investment in education</td>
</tr>
<tr>
<td></td>
<td>Inadequate rural connectivity due to licensing regimes, rapid payback models and reduced ROI for operators</td>
<td>Limited access to proper medical care</td>
<td></td>
<td>Cultural norms</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Low levels of trust in healthcare system</td>
<td></td>
<td>Commitment of leadership</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bad health translates to low economic productivity</td>
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<tr>
<td></td>
<td></td>
<td>Use ICT to maximize community-based health/reduce need for HSI.</td>
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<tr>
<td></td>
<td></td>
<td>Complete patients’ medical record database</td>
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<tr>
<td></td>
<td></td>
<td>Implement VNs and interconnect rural and urban health centers</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Low rural connectivity</td>
<td></td>
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<td></td>
<td>Commitment to inefficient data collection process</td>
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<td></td>
<td>Commitment of leadership</td>
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<td>Low rural connectivity</td>
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<td>Commitment of leadership</td>
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<td>Low rural connectivity</td>
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<td>Commitment of leadership</td>
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<td>Low rural connectivity</td>
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<td>Commitment to inefficient data collection process</td>
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<td>Commitment of leadership</td>
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<td>Low rural connectivity</td>
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<tr>
<td></td>
<td></td>
<td>Commitment to inefficient data collection process</td>
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</tr>
</tbody>
</table>
### Equipment and Supplies Shortage

In African countries, equipment and supply shortages are strongly associated with limited or unequal access to obstetric care. Without medical equipment and supplies it is difficult for health workers to provide the care they are capable of providing. According to a World Bank study, consumers in Sub-Saharan African countries only receive US$12 worth of benefits for every US$100 spent on drugs by the public sector due to wastage in the drug supply distribution network. Sometimes, supply shortages even lead to health center shutdowns. In 2010 in Uganda, for example, eight rural health centers closed due to lack of supplies, leaving people in the Amuru district without healthcare, and an additional twelve recently-built health centers have not opened due to lack of supplies. While African countries improve supply chain processes to better equip rural health facilities, they can also explore ICTs such as telemedicine to extend access to more sophisticated equipment (e.g., listed in Table 4) that exists in urban areas.

#### Table 4: Equipment whose services can be made available to rural areas

<table>
<thead>
<tr>
<th>Equipment Per 1,000,000 population</th>
<th>Botswana</th>
<th>South Africa</th>
<th>Uganda</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Resonance Imaging (MRI)</td>
<td>1.56</td>
<td>2.58</td>
<td>0.03</td>
<td>0.89</td>
</tr>
<tr>
<td>Computed Tomography (CT)</td>
<td>2.60</td>
<td>5.03</td>
<td>0.19</td>
<td>5.92</td>
</tr>
<tr>
<td>Gamma Camera or Nuclear Medicine</td>
<td>0.52</td>
<td>1.91</td>
<td>0.06</td>
<td>0.45</td>
</tr>
<tr>
<td>Mammography</td>
<td>6.00</td>
<td>216.00</td>
<td>4.00</td>
<td>215.00</td>
</tr>
<tr>
<td>Linear Accelerator</td>
<td>0.52</td>
<td>1.45</td>
<td>0.06</td>
<td>0.59</td>
</tr>
</tbody>
</table>

**Opportunity for ICT:** Telemedicine allows people living in remote areas to access the sophisticated equipment and expertise of urban areas. For example, the MILLENSYs tele-radiology program in South Africa allows rural hospitals to transmit radiological images via Internet connection from three rural hospitals to expert radiologists in Port Elizabeth and East London for diagnosis. mHealth can also be used for supply chain management purposes, as is the case in Kenya where mPedigree of Ghana and Telkom Kenya partner to transmit information between medical dispensaries, logistics management units, local pharmacists and patients to increase efficiency and fight against drug counterfeiting.

### Insufficient Quantity and Quality of Skilled Healthcare Workers

The Americas contain close to 40% of the total global health workforce, but only shoulder around 10% of the global burden of disease. In contrast, the African continent is home to nearly 25% of the global disease burden, yet only has 3% of the total global health workforce. While the literature indicates that there is an inverse relationship between child and maternal mortality and the healthcare worker population, the African continent has a shortage of 1.5 million healthcare workers. And while Rwanda had less than 700 physicians in 2009 and only one medical school, its neighbor Burundi, a country of 8 million people, has fewer than 200 doctors.

Figures 10 and 11 demonstrate that not all countries are faring badly. While Ghana, Ethiopia and Uganda don’t meet the 2 physicians-per-10,000 minimum recommended by the WHO in 2009, Botswana, Gabon, South Africa, and Tunisia do. Similarly, while Ethiopia, Mali and Rwanda don’t meet the 10 nurses and midwives per 10,000 minimum recommended by the WHO in 2009, Tunisia, Botswana, Uganda and Ghana do.
Figure 10 demonstrates that growing a large workforce of traditional and community health workers has not proven such a challenge for some countries finding it difficult to meet WHO-recommended minimums for physicians and nurses. For example, Ethiopia, which had 0.22 physicians and 2.3 nurses per 10,000 in 2009, raised the number of traditional and community health workers (CHW) to 30.3 per 10,000 (including nearly 30,000 health extension workers)—only 20 behind Botswana’s 52 CHW per 10,000.
The health worker challenges experienced by many countries are exacerbated by brain drain—the loss of manpower, often trained with national or regional funds, to foreign work opportunities. Ironically, there is a severe shortage of medical practitioners on the African continent, but there are many African-born physicians working in developed countries. Over 40% of doctors born in each of twenty-five African countries work abroad. Similarly, over 40% of professional nurses born in each of seven African countries work abroad. This problem is more serious for some countries than others; 75% of Mozambican-born doctors work abroad, as do 23% of Malian-born doctors and 30% of Ethiopian-born doctors. In fact, on average, 19% of doctors born on the African-continent work abroad. The average for Sub-Saharan African countries is 28%.194

**Opportunity for ICT:** Telemedicine and enhanced communication between hospitals and healthcare workers in rural areas can provide a vital connection to specialists in capital cities (e.g., the OpenClinic health information portal in Mali that provides tele-medical tools to health practitioners and connects ten health institutions throughout the country). Also, videoconference technologies can be used to train healthcare workers and improve communication and working conditions, which can reduce turnover among health workers.

**Population Uneducated About Prevention and Treatment of Preventable Diseases**

In order to halt and reverse the spread of HIV/AIDS and other preventable diseases such as malaria, people need to understand how the diseases spread and how they can be prevented and treated. MDG 6 can be achieved only through a combination of medical approaches and public education campaigns. As Figure 13 shows, in Botswana, where there are significant HIV/AIDS-focused public health information campaigns in the forms of radio programs, television programs and information hotlines, the percentage of 15-24 year-old women with comprehensive and accurate knowledge of HIV/AIDS is about 40%. In contrast, the percentages in Mali, Ethiopia and Gabon are lower at 18%, 20% and 24%, respectively. Though the HIV/AIDS prevalence in Mali, Ethiopia and Gabon is lower than that of Botswana, it is imperative these countries intensify their education programs to avoid regression.

**Opportunity for ICT:** Mobile technology can be used in a cost-effective manner to disseminate health education information through SMS-based informational campaigns. This is being done in the Mobile Midwife program (MoTeCH) in Ghana,195 which disseminates information about pregnancy and healthy child-rearing to expectant mothers through SMS.

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**Figure 11: Women’s and men’s (ages 15-24) comprehensive and correct knowledge of HIV/AIDS**

- Women 15-24 with comprehensive correct knowledge of HIV/AIDS
- Men 15-24 with comprehensive correct knowledge of HIV/AIDS

![Bar chart showing the percentage of women and men with comprehensive correct knowledge of HIV/AIDS in various countries.](chart.png)
Lack of Health System Infrastructure to Enable Rural-urban Communication

In addition to a lack of healthcare personnel, African nations have fewer hospitals, health centers, hospital beds, back-up power sources and specialized equipment than OECD and other emerging-market countries. The absence of these infrastructure elements increases the possibility of patient deaths due to “third delay,” the delay in receiving adequate service after reaching a healthcare facility. The impact is felt most by people in rural areas, where the deficiencies are more extreme. In Egypt, for example, the maternal mortality rate in the year 2000 was twice as high in the nomadic frontier regions as it was in the urban metropolitan centers (120 vs. 48 deaths per 100,000). And, as Table 5 illustrates, some countries, such as Gabon, South Africa and Uganda, have less than 1 hospital per 100,000 people, while a few countries seem to have a greater ratio of health posts in the rural areas.

Table 5: Healthcare infrastructure per 100,000 in 2009

<table>
<thead>
<tr>
<th>Healthcare Infrastructure elements per 100,000 persons</th>
<th>Gabon</th>
<th>Ghana</th>
<th>South Africa</th>
<th>Uganda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health posts</td>
<td>33.37</td>
<td>1.20</td>
<td>6.20</td>
<td>9.19</td>
</tr>
<tr>
<td>Health Centers</td>
<td>2.51</td>
<td>9.92</td>
<td>0.58</td>
<td>3.85</td>
</tr>
<tr>
<td>District/rural hospitals</td>
<td>2.78</td>
<td>1.41</td>
<td>0.56</td>
<td>0.35</td>
</tr>
<tr>
<td>Provincial hospitals</td>
<td>0.81</td>
<td>0.03</td>
<td>0.13</td>
<td>0.04</td>
</tr>
<tr>
<td>Regional/specialized/teaching and research hospitals</td>
<td>0.41</td>
<td>0.04</td>
<td>0.03</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Figure 14, below, shows countries such as Rwanda, Botswana, Tunisia and South Africa with 15-28 beds per 10,000 persons in 2009. By comparison, the United States had 34 beds per 10,000 people in the same time period.

Figure 12: Hospital beds per 10,000 in 2009

Only 38% of Sub-Saharan Africans live in urban areas. Though the conditions vary greatly, basic infrastructure (i.e., roads, power and telecommunications) linking rural and urban areas is often weak. For example, only 20% of African roads are paved, only 24% of the continent has electricity and 9.6% have Internet connectivity. These infrastructure problems translate to inefficiencies in the healthcare system.

Further, time and resources of health workers are often wasted as they must physically deliver medical records. For example, the CEO of Medic Mobile, Josh Nesbit, reports that rural community health workers in Malawi often have to walk tens-of-miles to report back to clinicians in adjacent towns.
Opportunity for ICT: Where health system infrastructure is deficient, ICT can be used for digital data collection, as is the case with the OpenMRS system in Rwanda. SMS can be used for remote data collection, as is done in the EpiHandy program in Uganda, the IHISM system in Botswana and the Dokoza system in South Africa. Mobile, video and IVR solutions can also be used by rural health service providers to create and send images, access medical information and institutional resources, and send automated alerts to patients with mobile phones.

Resolving Macro-level Challenges to Realize Health Sector Opportunities

Though some of the challenges faced by the health sector in African countries are of a micro nature and can be viewed with respect to only the health sector, Table 3 (above) indicates that other challenges are greatly influenced by macro-level (or national) challenges over which the health sector has no control. ICT has the capability to turn these challenges into opportunities to reduce cost, increase productivity and, when appropriately applied, improve health. However, persistent macro-level challenges also increase barriers to using ICT to address health sector issues. Without addressing macro-level challenges, implementation of ICT interventions becomes even more difficult for health sector stakeholders. This section discusses those macro-level challenges that so pervasively impact the micro-level health sector and ICT interventions. By resolving macro-level issues, African leaders increase the probability that ICT will improve the efficiency, scalability and sustainability of health sector services.

Capital Constraints

With a collective population of over 1 billion, capital constraints have reduced the ability of African countries to invest appropriately in healthcare and other sectors necessary to achieve the MDGs 4, 5, and 6.

Financial Capital

External debt servicing, illicit financial flows (IFF) and the shadow economy are but a few of the challenges African countries have faced in their attempt at capital formation and accumulation over the last 30 years.

Though the issue of debt is not as drastic as it once was, up to 2006, eighteen African countries, including Ghana, Ethiopia, Mali, Tanzania and Zambia, were servicing US$40 billion in external debt owed to the World Bank, International Monetary Fund (IMF) and African Development Fund. A 1984 conference on Africa’s indebtedness resulted in the Highly Indebted Poor Countries (HIPIC) initiative and The Multilateral Debt Forgiveness Initiative, which saved for these countries US$1 billion per year that could be used for more productive social programs. Yet, the impact of nearly 50 years of funds lost to servicing debts remains evident in these countries.

Equally debilitating is illicit financial flows (IFF), or funds taken or sent from a country illegally. This phenomenon is sometimes called “capital flight,” a term which Global Financial Integrity (GFI) considers a misnomer because it absolves developed countries of their share of the blame. A recent (2011) United Nations Development Program (UNDP) paper on the topic of capital flight reports that, between 1990 and 2008, 15 African countries were among the top 20 of 48 least developed countries (LDCs) to have suffered an estimated US$246 billion in illicit outflow, leaving them with a net cash flow loss of US$197 billion. At an implied growth rate of 6.2% per year, analysts conservatively estimate annual outflows to have grown from US$7.9 billion to US$20.2 billion between 1990 and 2008. This would mean that nearly two-thirds of African countries will have to grow their economies at a pace greater than 6.2% per year just to meet their budgetary needs. As a result, despite Equatorial Guinea’s booming natural resource industry, which produced US$18.5 billion GDP and US$28,103 per capita
GDP in 2008, the southwestern African country’s economic policies were harmed by an average of US$13.9 billion in illicit outflows from 1990 to 2008. Only Chad, Gambia and Sierra Leone had higher average outflows (in billions) of US$27.4, US$22.5 and US$14.7, respectively within that same time period.

Finally, the shadow economy remains an issue for most African countries. Shadow economies are legal economic activities whose revenues are not captured, recorded and taxed by governments. According to Prof. Friedrich Schneider of the Johannes Kepler University in Austria:

An increase of the shadow economy can lead to reduced state revenues which in turn reduce the quality and quantity of publicly provided goods and services. Ultimately, this can lead to an increase in the tax rates for firms and individuals in the official sector, quite often combined with a deterioration in the quality of the public goods (such as the public infrastructure) and of the administration, with the consequence of even stronger incentives to participate in the shadow economy.

The larger the shadow economy, the larger its impact on a country’s social service sectors. Along with external debt servicing and IFF, the shadow economy remains prominent in the mix of variables that make it difficult for African countries to invest domestically and compete internationally.

On a more positive note, some African countries have taken the renaissance of their financial capital into their own hands. A new breed of daring central bank governors are resurrecting the backbone of their financial systems—including re-instating and enforcing regulatory frameworks that meet international standards. They are also enabling these systems technologically with platforms that perform everything from ATM cash withdrawals to mobile money transactions. With a sovereign purpose, such countries as Ghana, Nigeria and Angola are tapping into the global capital markets to raise benchmark bonds that will allow them to replace external aid and continue developing their resources to provide adequate public services for their people.

**Human Capital**

At the heart of these sovereign efforts is the development of human capital—people who can add value to society. Yet the ability of African countries to develop quantity and quality human capital has, over the years, been hindered by a number of realities including rapid urbanization, the increasing cost of education, brain drain, high unemployment, and civil war. Of these, urbanization, education and brain drain merit further discussion.

Though 70% of the African continent’s population (growing at nearly 3% annually) is rural and sustained by smallholder farming, the UN-HABITAT reports that the urban population in African countries is expected to triple to 1.23 billion between 2010 and 2050. A shift in African society from 60% rural to 60% urban within 40 years would mark the fastest rural population decline in the world. At particular risk of adverse impact from rapid urbanization are such countries as Ethiopia, Rwanda, Mali and Equatorial Guinea, each of which has rural populations in excess of 60%. These countries will have to extend infrastructure beyond the cities and build human capacity much more rapidly than such highly urbanized countries as Gabon, Tunisia, South Africa and Botswana, each of which, as Figure 15 illustrates, has an urban population of more than 60%. They will have to retrain rural dwellers to use technology to their own benefit—for agriculture, trade, entrepreneurship, and personal wellness.
Figure 13: Urban population percentage

<table>
<thead>
<tr>
<th>Country</th>
<th>Urban Population Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>60%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>17%</td>
</tr>
<tr>
<td>Gabon</td>
<td>86%</td>
</tr>
<tr>
<td>Ghana</td>
<td>51%</td>
</tr>
<tr>
<td>Mali</td>
<td>33%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>19%</td>
</tr>
<tr>
<td>South Africa</td>
<td>61%</td>
</tr>
<tr>
<td>Tunisia</td>
<td>67%</td>
</tr>
<tr>
<td>Uganda</td>
<td>13%</td>
</tr>
<tr>
<td>Thailand</td>
<td>34%</td>
</tr>
</tbody>
</table>

One key to developing human capital is educating youth under age 15, who comprise 45% of the rural population and who will form the majority of the continent’s workforce within 10 to 15 years. Educating this segment would create opportunities that enable them to contribute wherever they live—rural or urban. As Rwanda’s President Paul Kagame recently stated when discussing capacity building, “The capacity we are talking about is organizational, institutional and human…. We are also thinking…beyond qualifications and skills…having people with a certain mindset, a certain attitude, a certain culture so that these useful qualities take us beyond the individual.” Building that attitude starts quite early.

If, however, neither educational nor employment opportunities are provided for young people, the pace of urban migration in many countries could increase. Consequently, the absence of manpower from rural areas might jeopardize national food security, while rapid urbanization could lead to more poverty, crime and disease. If countries with large rural populations implement and fund policies that build capacity amongst the rural youth, they could turn the communities into centers of agricultural growth for food sovereignty that produce incremental opportunities for future generations.

As African countries build human capacity, and provide the infrastructure and jobs necessary to retain the best and brightest, they will discourage brain drain and encourage “brain gain.” This would be one step towards accumulating intellectual capital.

**Intellectual Capital**

One of the benefits of developing human capacity is a country’s ability to generate and retain marketable intellectual capital that can accelerate national income. By keeping the best and the brightest inside their borders, countries can capture the intellectual capital that results from the collaboration of end users, government, industry, researchers and civil society. However, tight funding scenarios and the absence of infrastructure and civic capacity has made it difficult for many African countries to focus on and accumulate intellectual capital.

Despite membership to the World Intellectual Property Organization (WIPO) and World Trade Organization (WTO), many African countries have not yet developed fully functioning technology transfer systems. These would include a strong research backbone that informs national and regional policy, and the generation of new products and services. Healthy academic-public-private sector collaboration would protect domestic and international patent, trademark and copyright laws and create market incentives that encourage innovation and wealth creation. Though such a system would maximize the value of their intellectual capital, the reality is that many African countries sell valuable assets too early and cheaply due to the need to generate funds, thus
compromising the future value of intellectual capital such as telecommunication frequency spectrum and rare pharmaceutical plants.

Though there is anecdotal evidence of increased value for intellectual property as African entrepreneurs profit from multi-billion-dollar acquisitions by multinationals, much more needs to be done by government to maximize value for public assets. By so doing, governments can increase revenues from auctions, licensing, franchises and agency fees, and apply those returns to fund the health sector.

An intellectual capital agenda such as the one described above could accelerate revenue generation to facilitate such critical public services and initiatives as healthcare, food sovereignty and social security. However, such an agenda must be supported by a firm commitment to capacity and infrastructure development.217

Capacity Building

The World Bank spent nearly US$10 billion on capacity building in Africa from 1995 to 2004.218 In addition to system, process, and resource improvements, special attention was paid to preparing the public workforce to provide public services to citizens and the private sector. This was especially necessary as a market-based privatization strategy for the telecommunications, banking and energy sectors was advocated by multi-lateral aid organizations such as the World Bank, FMO, and International Monetary Fund. Yet organizational, process and regulatory challenges continue to inhibit many African countries from achieving their social developmental goals.

Organizational Issues

Most African countries are now democratic. However, extending the social dividends of democracy to the people remains a challenge. One reason is that some of the countries are still working to create the institutions that will support the ambitions of the people. For example, the recent elections in Nigeria required a restructuring of the electoral system and voter registration for over 70 million potential voters. Former dictatorial nations are now managed internally by leaders that have had to adjust to pluralistic views, decentralized power, tiered governance, rule of law and transparent policies. A similar challenge exists at the regional and continental levels as each country adjusts to new geo-political norms. As countries transition to electronic data management systems, they may find it much easier to manage leadership and information transfer.

Process Considerations

Since 2001, the telecommunication industry has empowered end-users and investors on the African continent with availability and choice of service. This is not a small constituency: there are nearly 500 million mobile phone users in Africa, according to the International Telecommunication Union (ITU). This has changed the expectation for speed and quality of service in most African countries. Consumer demand has led to increased information flow, reduced arbitrage and more accountability for leaders, who must now meet international benchmarks, metrics and standards. Suddenly, a country’s business-friendliness can be assessed through websites and reports that calculate the number of days required to register a commercial enterprise in that country. In addition, an empowered electorate now demands similar service delivery from the public sector. However, process constraints remain evident.

For instance, in many countries, administrative processes and management of forms are still done by hand. This is the case in Ethiopia, where many health sector forms that are passed from Addis Ababa, the center of
government, to regions and communities, are hand-filled. If properly executed, the introduction of health information systems (HIS) to complement the country’s telecommunication network should reduce inaccuracies and delays caused by hand-processing forms.

**Regulatory Concerns**

As part of the transition to democracy and deregulation, many African countries are fine-tuning and standardizing their regulatory systems to permit interoperability across regional economic communities. This is especially true for the telecommunications, oil and gas industries, which have been the focus of privatization programs for 10 years. Yet, policies and regulatory frameworks for the banking and power sectors are still incomplete or ineffectual in many countries, making it difficult for internal or external investors to fully participate. Further, policies and regulations that could stimulate technology transfer and innovation have yet to receive due attention. Finally, there is a risk in some countries that regulatory barriers could delay cross-sector collaboration in strategic sectors such as finance and telecommunications. Such risks could spill over into the health sector, whose efficacy could depend on cross-sectorial collaborations and transactions.219

**Infrastructure**

The weak infrastructure of African countries is a primary factor in their struggle to provide access to quality social services such as healthcare.220 According to the World Bank (2010), African countries would collectively require US$93 billion per annum over 10 years to build enough federal and municipal infrastructure in power, transportation (air, road, rail), water, and ICT to achieve the Millennium Development Goals (MDGs) by 2015.221 Though mobile telecommunications coverage is quickly approaching 100% in every country, equal attention has yet to be paid to power, Internet, transportation and municipal services. Improved infrastructure could increase economic growth by 2 percentage points annually and would rejuvenate business productivity by up to 40%.222 Thus, it is possible that a collaboration to develop infrastructure that maximizes cross-sector information exchange and economic transactions would help bring social services to people on the Continent.223

**Socio-Cultural Pressures**

Often not described in development literature, socio-cultural pressures play an important role in decision-making on the African continent. Social or cultural pressures may sway decisions on many health-related issues, including diets, biases against medication, gender interaction, and contraception. The fact that these pressures may impact young people, in particular, could pose a significant challenge to a generation intent on improving the social well-being of a population.

**Inadequate Social Safety Net**

Equally challenging to the development of African nations is the existence of inadequate social safety nets. For many Africans, the only dependable safeguard against unemployment, homelessness or starvation is the family. And those without family or other means of support are left abandoned and struggling. Part of the issue is that the pension and insurance systems are dysfunctional; many people are excluded and those who participate often do not accumulate enough to support themselves. Another contributor to this challenge is an inadequate entrepreneurial infrastructure. The lack of mentors, support, funding, an enabling environment, and policies to support entrepreneurship poses more challenges when social safety nets are absent.
Chapter 4: Country Case Studies

Ethiopia Case Study

Country Profile

Ethiopia, with almost 85 million people,\(^2\) is both East Africa’s demographic heavyweight and one of its fastest-growing economies. The oldest independent nation on the continent, it has emerged from decades of political turmoil and economic instability and entered into a period of ambitious growth and development planning. The country remains overwhelmingly rural and dependent on agriculture, with 83% of the population residing in rural areas\(^2\) and agriculture accounting for 41% of GDP, meaning that these areas remain the focus of many of the country’s development initiatives.\(^3\) GDP per capita has doubled between 2003 and 2010, from less than US$500 to just over US$1,000,\(^4\) and extensive cooperation with bilateral and multilateral donors has allowed the government to expand social services aimed at the rural poor. Improved economic and political conditions, in addition to expanded health programs, have allowed the government to make progress in improving key health indicators. In addition to increasing the reach of services to rural populations through the construction of facilities and the deployment and training of personnel, the government has invested significantly in improving the organization and efficiency of its social services, an area in which ICT could play a major role.

Health Profile

Figure 14: Health profile. Sources: WHO, Ethiopian Federal Ministry of Finance and Economic Development, World Bank

- Life Expectancy at Birth (2009): 54
- Under-5 Mortality Rate (2009): 104 per 1,000 live births
- Maternal Mortality Rate (2008): 470 per 100,000
- Prevalence of Tuberculosis (2009): 572 per 100,000
- Per Capita Expenditure on Health (2009): US$14.68
- Expenditure on Health as % of GDP (2009): 4.3%
- Births attended by Skilled Health Personnel (2005): 20.3%
- Rural Births Attended by Skilled Health Personnel (2005): 3%
- Physicians (2009): 0.2 per 10,000
- Nurses/Midwives (2009): 2.4 per 10,000
- Hospital Beds (2009): 76 per 10,000
- Major causes of Death for Children Under-5: Diarrhea, Pneumonia, Birth asphyxia

Ethiopia’s major health issues continue to be maternal and child mortality, preventable communicable diseases and nutritional disorders. The Ethiopian Ministry of Health’s Health Sector Development Program report notes that while progress has been made to improve the health of its population, high rates of morbidity and mortality persist. Major constraints include shortage of skilled midwives, a weak referral system at the health center levels, inadequate availability of equipment for obstetric and neonatal care, and under-financing of health services.\(^5\)
Progress towards Millennium Development Goals

Table 6: Progress towards Milenium Development Goals

<table>
<thead>
<tr>
<th>Goal 4: Reduce Child Mortality</th>
<th>2001</th>
<th>2009</th>
<th>Change</th>
<th>On Schedule to Meet MDG</th>
<th>Global Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under-Five Mortality Rate (per 1,000 live births)</td>
<td>167</td>
<td>101</td>
<td>-39.52%</td>
<td>YES</td>
<td>60</td>
</tr>
<tr>
<td>Infant Mortality Rate (per 1,000 live births)</td>
<td>97</td>
<td>45</td>
<td>-53.61%</td>
<td></td>
<td>42</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goal 5: Improve Maternal Health</th>
<th>2000</th>
<th>2008</th>
<th>Change</th>
<th>On Schedule to Meet MDG</th>
<th>Global Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Mortality Rate (per 1000,000 live births)</td>
<td>750</td>
<td>470</td>
<td>-37.33%</td>
<td></td>
<td>260</td>
</tr>
<tr>
<td>Proportion of births attended by skilled health personnel</td>
<td>5.6%</td>
<td>15.70%</td>
<td>180.36%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antenatal Care Coverage</td>
<td>67</td>
<td>68</td>
<td>1.49%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goal 6: Combat HIV/AIDS, Malaria and Other Diseases</th>
<th>2001</th>
<th>2009</th>
<th>Change</th>
<th>On Schedule to Meet MDG</th>
<th>Global Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>People living with HIV, 15-49 years old, percentage</td>
<td>2.4%</td>
<td></td>
<td></td>
<td></td>
<td>0.8%</td>
</tr>
<tr>
<td>Prevalence of Tuberculosis per 100,000</td>
<td>528</td>
<td>572</td>
<td>8%</td>
<td></td>
<td>201</td>
</tr>
</tbody>
</table>

Sources: WHO, Ethiopian Federal Ministry of Finance and Economic Development, Vital Wave Consulting

Healthcare Policy and Strategy

The main goal of health policy in Ethiopia is the provision of basic universal healthcare. To reach this goal, health policy-makers have committed to the democratization and decentralization of the healthcare system, and the development of preventive, curative and universal healthcare. This commitment includes greater participation of the private sector and NGOs in the health sector. New policies focus on expanding the health workforce in rural areas, improving the health supply chain, strengthening the Health Management Information System (HMIS) and upgrading health centers into rural hospitals.

Under HSDP II in 2003, the Federal Ministry of Health (FMOH) created the Health Extension Program, which is designed to bring healthcare services and infrastructure to Ethiopia’s rural population. This initiative works through the creation of rural health centers and by training Health Extension Workers (HEWs). The target of the program was to train 30,000 HEWs to work in 15,000 villages by the end of 2010 each with a health post that provides basic care to the village. By the end of the fourth year of the program, a total of 31,831 HEWs were trained and deployed, which is above the target (103%). The Ethiopian government registered an encouraging achievement with regard to construction of health posts, meeting 83.1% of the overall HSDP III target at the end of the fourth year. The cumulative number had doubled from 6,191 in 2005 to 12,488 in 2009. Also, along
with building out the health infrastructure in rural areas, the FMOH is focusing on upgrading health centers to rural hospitals. This equates to 800 hospitals which will serve 1 per 100,000 individuals.\textsuperscript{232}

To improve the health system’s supply chain management, a major area of weakness, the FMOH teamed with John Snow Inc. (JSI), with funding from USAID, on the DELIVER PROJECT. In a multi-year effort starting in 2003, JSI and the FMOH worked in a country-wide project to strengthen the Logistics Management Information System (LMIS) in order to ensure the availability of vital health supplies. This included developing efficient delivery systems, ensuring transparent and cost-effective procurement and establishing supply chains that work both domestically and internationally.\textsuperscript{233}

The FMOH collaborated with JSI on two other supply chain projects. The first, the Improving Supply Chains for Community Case Management of Pneumonia and Other Common Diseases of Childhood (SC4CCM) project, focuses on improving supply chain management at a local level in order to improve the treatment of children under five.\textsuperscript{234} The second Supply Chain Management System (SCMS) focuses on providing the procurement and distribution of medicines and supplies needed for HIV/AIDS patients.\textsuperscript{235}

Finally, in another multi-year effort with JSI and Tulane University, the FMOH improved their health management information system (HMIS) in order to increase data reliability in two phases. The first phase implements a standardized paper data collection process to collect more accurate data and train medical personnel to analyze and interpret the data to improve services. The second phase will implement ICT into the data collection process once the processes of the paper system are well established.\textsuperscript{236}

### ICT Infrastructure

**Figure 15: Ethiopia ICT Infrastructure. Sources: Vital Wave Consulting, ITU, GSMA**

<table>
<thead>
<tr>
<th>Mobile Phone Subscribers (2010):</th>
<th>80 per 1,000 inhabitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Line Subscribers (2010):</td>
<td>11 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Ratio of Mobile Phones to Fixed Line Subscribers (2010):</td>
<td>7.2:1</td>
</tr>
<tr>
<td>Internet Users (2010):</td>
<td>7.5 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Fixed Internet Subscribers (2009):</td>
<td>0.9 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Mobile Call Price for 1-minute local (2011):</td>
<td>US$0.06</td>
</tr>
<tr>
<td>Price of one SMS PPP (2010):</td>
<td>US$0.02</td>
</tr>
<tr>
<td>Mobile Coverage (2011):</td>
<td>85%</td>
</tr>
<tr>
<td>Mobile Provider: Ethio-Telecom</td>
<td></td>
</tr>
</tbody>
</table>

**Telecom:** Ethiopia’s telecommunications industry is a state-owned monopoly that is managed by private concerns. Since 2006, as much as 10\% of the country’s annual GDP has been devoted to expanding the country’s telecommunications infrastructure. As part of a restructuring driven by a desire to increase service adoption, the former Ethiopian Telecommunications Corporation (ETC) was dissolved.\textsuperscript{237} In its place came Ethio Telecom (ET) which is run by France Telecom (FT) under an exclusive, performance-based management contract. The contract gives FT the responsibility of expanding service offerings, stimulating demand, increasing
subscriptions, increasing revenue and managing costs. In return for their management expertise, 24 FT employees are paid salaries which FT receives a percentage of ET’s revenues. The Ethiopian Telecommunication Agency (ETA) is the regulator and licensor of frequency spectrum while the newly formed Ministry of Communication and Information Technology (MCIT) represents all public-sector telecommunications service needs and requests. ET accepts private-sector service requests directly from the individual or company.

Ethiopia’s telecom infrastructure utilizes both CDMA and GSM mobile and fiber technologies. The GSM network has over 6 million subscribers and covers roughly 64% of the country, reaching into the woredas (towns/communities), and situated about 5 to 10 kilometers from the kabeles (rural villages). The CDMA network is more expansive, covering 90% of the country and making it the single most extensive in-country telecommunications network, by square kilometer, on the African continent. At speeds that reach 156kbps, this CDMA network is the core of the Rural Connectivity Program (RCP). It is capable of transmitting mobile voice, SMS, limited data, Internet and video services. Developed with the Chinese company ZTE, the RCP is intended to provide universal phone access within 10km of all citizens. ZTE financed the network expansion through a US$1.5 billion vendor financing agreement. In order to reach capacity goals, another US$1.5 billion will need to be invested. As of mid-2011, arrangements were being made to identify the appropriate partners.

The fiber network connects Addis Ababa with all regional capitals and each woreda. There were plans to triple the fiber network size in 2011.

Despite these relatively strong communications networks, Ethiopia has one of the lowest rates of mobile phone ownership in Africa – roughly 8% of the total population. Though the government believes that inadequate demand management is the primary reason, others have attributed the low penetration to the absence of competition. The next few years will be critical for increasing penetration, particularly as many service providers on the African continent place more emphasis on meeting data needs within the convergent ICT environment of their markets. In order to compete, Ethiopia will have to follow suite.

**Enabling Infrastructure**

**Power**

The country’s power comes from the Ethiopian Electric Power Corporation (EEPCO). Currently, Ethiopia generates more power than it consumes. However, only 41% of towns and villages had household access in July 2010. EEPCO has forecasted that 75% of towns and villages will be covered within 5 years and 100% will be covered within 10 years. Ethiopia is seen as having the potential to be one of the largest providers of hydroelectricity in Africa, but the country is not reaching its potential. The lack of power coverage is seen as a major problem to businesses in Ethiopia. In the health sector, lack of electricity is a problem for rural health posts. In response, the FMOH installed solar panels at 200 health posts by December 2010, with 500 more units expected by June 2011 and 5,000 by mid-2015.

**Roads**

Particularly in rural areas, the road and transportation system can delay supplies and critical information at health posts, and thus prevent patient access to timely treatment. In most African nations, rural road networks carry less than 10% of the traffic. However, in Ethiopia where 83% of the population is rural, rural roads carry more than 20% of the traffic. Funding for road improvements depends on the government budget. Unlike in many
African countries where governments place levies on fuel to fund road maintenance, Ethiopia has had difficulties collecting levies and therefore relies on limited general budgets to improve roads.\(^242\) This reality has contributed partially to the fact that less than 15% of roads in the country have been paved.\(^243\) Nonetheless, roads have been constructed between major cities and towns, thus enabling transportation to hospitals and clinics. Health posts still remain difficult to reach.

### eHealth Projects

Ethiopia has many examples of eHealth projects that show a range of ICT applications for healthcare. While this report highlights RapidSMS, the following are other examples:

- **Journey of Life Radio Show**: A radio serial drama in which the characters engaged in either risky or safe sex. The show is intended to promote prevention of HIV/AIDS and unwanted pregnancies to at-risk young adults.\(^244\)

- **Wegen AIDS Talkline**: A toll-free phone line providing information, telephone counseling and referral services on HIV/AIDS, STI’s and tuberculosis-related topics.\(^245\)

- **eLearning**: An online workshop in which trainers of Health Extension Workers (HEWs) and nurses are taught basic computer skills in order to access medical information. The program includes expanded eLibraries that are accessible at three health centers in Ethiopia.\(^246\) The program is made possible by Ethiopia’s extensive peri-urban broadband network for federal and municipal functionalities.

- **EpiSurveyor**: In partnership with John Snow Inc. (JSI), Datadyne implemented their mobile software (EpiSurveyor) in July 2010 to perform data collection via mobile phones instead of paper forms.\(^247\)

- **National E-government Network and Data Center**: National e-government networks include WoredaNet, which connects over 565 government offices, SchoolNet, which connects over 700 secondary schools, and AgriNet, which connects 49 agricultural research centers throughout the country.\(^248\)

- **Health Management Information System (HMIS)**: A digital medical health record system used in Ethiopia’s southern region services over 16 million people.\(^249\)

- **Supply Chain Management (SCM)**: There are two notable SCM programs in Ethiopia. The first, Supply Chain for Community Case Management (SC4CCM) increases access to essential health products for treating children under five. The second, Supply Chain Management System (SCMS) focuses on the procurement and distribution of necessary medicines and supplies for the treatment and care of HIV/AIDS patients.\(^250\)

- **RapidSMS**: UNICEF and RapidSMS partnered to customize the RapidSMS platform to handle supply chain management of a food distribution program during a famine in Ethiopia.
Macro-level Challenges and Opportunities

Human Capital Constraints

Ethiopia’s human capital challenges include a large and growing population, ethnic and linguistic diversity, low literacy rates, rural-to-urban migration and brain drain. The country has a large youth population (46.1% under 14) and a high population growth rate (3.2%), making the provision of employment and education to young people a great challenge.\textsuperscript{251} The government is structured as an ethnic federalist system, allowing each student the right to learn and be taught in their own language as well as in the national language of Amharic and English.\textsuperscript{252}

This policy of ethnic federalism, introduced in 1991, created a multi-lingual work force. However, with such a large variety of languages, there are challenges to establishing standardized communications systems.\textsuperscript{253} As a consequence, only 36\% of the adult population is literate—one of lowest rates on the African continent. There is also a large discrepancy between male and female youth literacy—62\% and 39\%, respectively.\textsuperscript{254} In order to improve this rate the government has committed to spend the equivalent of 5.5\% of its GDP on education.\textsuperscript{255} At the same time, rural-to-urban migration has increased informal sector activity and urban poverty.\textsuperscript{256}

The emigration of skilled and trained workers, usually trained with government funds, has also reduced human capital for over 30 years. Between 1980 and 1991, for example, 75\% of Ethiopians who traveled abroad to complete school did not return.\textsuperscript{257} Ethiopian-born medical personnel have been significant to the workforce exodus. In 2000, for example, 30\% of Ethiopian-born physicians and 17\% of Ethiopian-born nurses were working outside the country.\textsuperscript{258}

Organizational Issues

The Ethiopian government is set up as a federal republic and divided into two chartered cities and nine ethnic regional states. These regional states are further divided into 68 zones that consist of over 600 woredas, which are similar to districts or counties. The average population in a woreda is 100,000. Woredas are subdivided into kebeles, or neighborhoods. With over 80 million people, mostly in rural areas, this structure allows for broad government administration. It also allows decentralization of governance to regions, districts and neighborhoods while keeping strong federal oversight.

This structure in the hands of a ruling party that has exhibited political will has helped increase public service delivery in rural areas. Among these services is healthcare, with a focus on maternal and new born child health, and within an “access first, quality second” policy framework. The FMOH has also created a three-tier healthcare delivery system built around the woreda health system. In each woreda, there is a primary hospital (each serving 60,000 to 100,000 people), health centers (1 per 15,000 to 25,000 people) and satellite health posts (1 per 3,000 to 5,000 people). Each is connected to the other by a referral system.\textsuperscript{259} This structure allows for local problems to be handled by the local governments while the federal government focuses on policy and national implementation.

The fact that the Ethiopian government owns ET presents a dichotomy in the development and implementation of eHealth initiatives. While it might take significant amounts of time to acknowledge projects, eventual acknowledgment usually enjoys complete federal commitment. As such, continued government ownership of ET assures infrastructure expansion into rural areas which are not always profitable. This infrastructure is a key
component to universal eHealth. At the same time, some would argue that a monopoly (though technically a public-private partnership) decreases innovation and services while increasing prices.

However, ET has managed to keep prices competitive with that of most other East African service providers. Thus, it appears that price increases applied to telecommunication services provided to government agencies are based partially on market rates established in other African markets. Despite the fact that subsidies for federal agencies have been dramatically reduced, ET and MCIT have made clear their commitment to working with government entities like the FMOH to leverage telecommunication assets.

**Socio-cultural Pressures**

With Ethiopia’s large, culturally diverse population, there are pressures from the traditional aspects of their society that impact the healthcare system. This is especially true with women’s health, where there is a perceived need to preserve traditional practices. For example, 65% of older women said female circumcision should be preserved and it is shameful if a woman delays childbirth until an older age. Only 53% of younger women held this view. Another study found that 60% of rural women use traditional practices to maintain their health. This focus on the traditional in administering health within an environment of diverse cultural and language complicates demands on national healthcare policy development.

**Health Sector Challenges and Opportunities**

**Funding Shortage**

In 2009, the government spent US$14.68 per capita on health, a large increase over the US$5.32 per capita spent in 2000. Nonetheless, the total health expenditure relative to the size of the economy (as a percentage of GDP) has remained almost constant from 2000 to 2009 (~4.26%). Even with the increase in per capita expenditure, there is no guarantee that medical services reach the rural population. Often, healthcare needs are in competition with those of other sectors such as education. This further emphasizes the need for Ethiopia and other African countries to work with civil society, researchers and private investors to encourage and develop private-sector and public-private healthcare services. Such private investments and collaborations are strongly encouraged by the International Finance Corporation (IFC), the private equity arm of the World Bank.

**Figure 16: Opportunity and challenges for funding shortage**

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitalized processes allow health workers to be more effective and efficient at their jobs</td>
<td>The need for greater investment in the healthcare system</td>
</tr>
<tr>
<td>Use mobile tools to connect health workers with trained medical personnel in order to help with diagnosis and referral</td>
<td>Cross-sectorial cooperation between ET, MCIT and the FMOH needed to offset decreases in ICT subsidies to other government agencies</td>
</tr>
<tr>
<td>Use the revenues from the growing mobile market in Ethiopia to finance greater government health expenditures</td>
<td></td>
</tr>
<tr>
<td>Examples in Ethiopia: EpiSurveyor; E-government networks and data centers</td>
<td></td>
</tr>
</tbody>
</table>
Equipment and Supplies Shortage

According to UNICEF, over 60% of rural health posts have basic equipment such as delivery beds and weighing scales. However, supply chain and inventory management of medical supplies and materials for rural HEWs is a logistical problem of considerable magnitude. HEWs are not trained in inventory management, and supplies are generally ordered on an ad hoc basis. HEWs typically have no system to keep track of what has been used, and only 14% of HEWs keep records about stock levels. Even when supplies are ordered, shipping may be delayed by poor communication or transportation.

Nearly all HEWs must pick up supplies themselves, taking them away from their duties and preventing them from providing care. Further problems, such as transportation, distance, trouble carrying supplies and impassible roads cause problems for HEWs and resupply centers alike. Even when HEWs make it to the center, supplies that were ordered may not be there. The FMOH is trying to improve the processes through the DELIVER PROJECT by implementing LMIS and improving the SCMS. These multi-year projects are still being implemented.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Supply management and inventory applications to gather and analyze stock availability.</td>
<td>• No country-wide standardized process for management of supplies and inventory</td>
</tr>
<tr>
<td>• Examples in Ethiopia: Supply Chain Management (SCM)/Logistics Management and Information Systems (LMIS)</td>
<td>• Improvement of rural connectivity needed</td>
</tr>
<tr>
<td></td>
<td>• Behavioral change for health personnel required</td>
</tr>
</tbody>
</table>

Insufficient Quantity and Quality of Skilled Healthcare Workers

Ethiopia has a severe shortage in doctors and nurses, with only 0.2 physicians and 2.4 nurses per 10,000 people in 2009. However, the country is seeking to overcome this problem through the use of traditional and community health workers (CHWs), who number 30.3 per 10,000 (including nearly 30,000 health extension workers). Upon completion of training, HEWs become salaried government workers and serve at the village level alongside another HEW. Each HEW is expected to spend 75% of her time in the field interacting with villagers, and the other 25% staffing the health post. While in the field, HEWs have two tasks. The first is to involve community leaders and members in three major educational areas: 1) disease prevention and control; 2) family health service, and; 3) hygiene and environmental sanitation. The second is to run the “Model Families” program, in which HEWs train influential and respected families to adopt desirable health practices. Model families are expected to lead by example and share information with other community members.
Figure 18: Opportunity and challenges for skilled healthcare workers

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Utilize telemedicine to connect HEWs to the appropriate health personnel in order to receive assistance in diagnosing and referring patients.</td>
<td>• Training 30,000 HEWs to use mobile devices and applications</td>
</tr>
<tr>
<td>• Use mobile applications to connect patient data to both register and keep continuous records.</td>
<td>• Overcoming language barriers in written information</td>
</tr>
<tr>
<td>• Leverage ICTs to allow for the continued training of HEWs while they are still in the field.</td>
<td>• Dealing with technology limitations on the quantity of information that can be delivered.</td>
</tr>
<tr>
<td>• Examples in Ethiopia: Health Management Information System (HMIS); eLearning; E-government networks and data center</td>
<td></td>
</tr>
</tbody>
</table>

Population Uneducated About Prevention and Treatment of Preventable Diseases

Ethiopia has a severe lack of knowledge about HIV/AIDS. Only 20% of women and 33% of men ages 15-24 have comprehensive, correct knowledge of HIV/AIDS. The use of condoms is also an alarming issue, with only 11% of females and 9% of males between 15 and 49 using condoms during higher-risk sex.268 According to Ethiopia’s MDG Report 2010, 75% of women had heard about malaria, but only 38% of women in high probability areas of malaria listed a mosquito net as a method to protect against the disease.

Figure 19: Opportunity and challenges for preventable diseases

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Utilize radio, TV and mobile technology to disseminate information about how to avoid and treat preventable diseases.</td>
<td>• Low penetration of mobile phones and Internet users</td>
</tr>
<tr>
<td>• Examples in Ethiopia: Wegen AIDS Talkline; Journey of Life Radio Show</td>
<td>• Low literacy rate</td>
</tr>
<tr>
<td></td>
<td>• Language diversity</td>
</tr>
</tbody>
</table>

Lack of Health System Infrastructure to Enable Rural-Urban Communication

One of the biggest challenges to the healthcare system in Ethiopia is the high percentage of Ethiopians who live in rural areas. The FMOH has answered this with the HEW program.269 There are just over 15,000 health posts in Ethiopia, with two HEWs at each post. But these posts are often ill-equipped and lack electricity. Roads are also an issue, making it difficult for patients, workers, supplies and information to access or leave the health posts. Patients also struggle to reach hospitals if they need special treatment.

Figure 20: Opportunity and challenges for rural-urban communication

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Connect the HEWs with trained medical staff for proper diagnosis and referral.</td>
<td>• Lack of country-wide standardization of processes</td>
</tr>
<tr>
<td>• Examples in Ethiopia: E-government networks and data centers</td>
<td>• Limited connectivity</td>
</tr>
<tr>
<td></td>
<td>• Poor communication and transportation infrastructure</td>
</tr>
</tbody>
</table>
Table 7: Summary of the specific challenges and opportunities for ICT interventions in Ethiopia

<table>
<thead>
<tr>
<th>ICT Interventions Method</th>
<th>Systemic (macro-level) Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Constraints</td>
</tr>
<tr>
<td>1 Digital Health Ecosystem (DHE)</td>
<td>X</td>
</tr>
<tr>
<td>2 SMS</td>
<td>X</td>
</tr>
<tr>
<td>3 IVR</td>
<td>X</td>
</tr>
<tr>
<td>4 Video (telemedicine)</td>
<td>X</td>
</tr>
<tr>
<td>5 Radio</td>
<td>X</td>
</tr>
<tr>
<td>6 TV</td>
<td>X</td>
</tr>
<tr>
<td>7 HMIS</td>
<td>X</td>
</tr>
</tbody>
</table>

Table 8: Summary of health sector challenges

<table>
<thead>
<tr>
<th>Health Sector (micro-level) Challenges</th>
<th>Systemic (macro-level) Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Constraints</td>
</tr>
<tr>
<td>1 Funding Shortage</td>
<td>X</td>
</tr>
<tr>
<td>2 Equipment and Supplies Shortage Insufficient Quantity of Skilled Healthcare Workers</td>
<td>X</td>
</tr>
<tr>
<td>3 Insufficient Quantity of Skilled Healthcare Workers</td>
<td>X</td>
</tr>
<tr>
<td>4 Population Uneducated About Prevention and Treatment of Preventable Diseases</td>
<td>X</td>
</tr>
<tr>
<td>5 Lack of Health System Infrastructure to Enable Communication Between Rural and Urban Centers</td>
<td>X</td>
</tr>
</tbody>
</table>
Figure 21: RapidSMS

Name: RapidSMS
Application Area: Supply Chain Management
Date Started: 2008
Sponsoring Organization and Partners: UNICEF and RapidSMS
Locations: Southern regions of Ethiopia
Scope: During a one month trial period, a total of 939 mobile text message reports were received from 1,852 distribution centers representing a 44% monitoring coverage (includes multiple calls from some distribution centers).
Target Market: Supply staff at health and/or nutrition-based programs

Description: The RapidSMS system allows for mass-scale monitoring, data collection and information sharing from monitors using mobile telephones in the field. The system allows data collected from mobile phones to be sent to a central server via text message and compiled into a real-time correlated report. The system can also be used to send out SMS messages to multiple users in the field. The new RapidSMS system enabled the collection of data on stock balance, new admissions, location of distribution centers, and the quantity of Plumpy’nut received and consumed in pilot districts. The RapidSMS platform could be customized to provide a solution that would take advantage of the widespread availability of mobile phones to improve the capability of UNICEF to monitor supplies. This customization, RapidSMS, is a flexible distribution monitoring package which can be reconfigured to any supply or situation (e.g., drug supply, bed-net distribution, etc.), and deployed at short notice (with some requirements).

How it works: The UNICEF office in Ethiopia worked with its New York-based Innovation Center to evaluate the RapidSMS platform. The program was both implemented and funded by UNICEF. Using the RapidSMS platform, UNICEF customized the application to meet its specific supply chain needs and requirements in Ethiopia. The FMOH assisted in the coordination of the emergency program but was not involved in the customization of the RapidSMS platform.

Micro-level Challenges Addressed: Equipment and Supplies Shortage; Lack of Health System Infrastructure to Enable Communication between Rural and Urban Centers

Efficacy: RapidSMS was successfully trialed in Ethiopia and one of the immediate benefits noted was real time reports that enabled the Nutrition Program to react immediately to a problem as opposed to the old system of waiting for monitors to return from the field. In addition, the new RapidSMS system enabled the collection of data on stock balance, new admissions, location of distribution centers, and the quantity of Plumpy’nut received and consumed in pilot districts.

Challenges to Implementation: The followings are the details of (user) problems encountered: coding of each distribution center and Woreda, compiling a large quantity of data into Excel format, failures in telecommunications system, absenteeism among alert monitors, data entry errors and lack of clarity about which partner (NY, Addis Ababa or logistics) need to resolve technical issues.

Comments: “The impact a RapidSMS implementation has on UNICEF’s work practices is dramatic. In October 2008, Ethiopia experienced crippling droughts. Faced with the possibility of famine, UNICEF Ethiopia launched a massive food distribution program to supply the high-protein food Plumpy’nut to under-nourished children at more than 1,800 feeding centers in the country. Previously, UNICEF monitored the distribution of food by sending a small set of individuals who traveled to each feeding center. The monitor wrote down the amount of food that was received, was distributed, and if more food was needed. There had been a two week to two month delay between the collection of that data and analysis, prolonging action. In a famine situation each day can mean the difference between recovery, starvation, or even death. The Ethiopian implementation of RapidSMS completely eliminated the delay. After a short training session the monitors would enter information directly into their mobile phones as SMS messages. This data would instantaneously appear on the server and immediately be visualized into graphs showing potential distribution problem and displayed on a map clearly showing where the problems were. The data could be seen, not only by the field office, but by the regional office, supply division and even headquarters, greatly improving response coordination. The process of entering the data into phones was also easier and more cost effective for the monitors themselves leading to quick adoption of the technology.” UNICEF Innovation
Lessons from Ethiopia

Like many African nations, Ethiopia faces multiple challenges to improve the health status of its citizens. These challenges range from the macro level (funding, human capital, infrastructure, cultural norms) to specific health-sector challenges (equipment and supplies shortage, insufficient quantity of skilled healthcare workers, a relatively uneducated population). Through its actions over the last six years, the Ethiopian government has demonstrated how ICT can be used to improve the efficiency and effectiveness of government service delivery. This is evident in the e-government initiative that connects the complex federal system. In the healthcare sector, there have also been efforts by government and its developmental partners to apply ICTs interventions to improve data exchange within hospitals and to support HEWs in rural areas.

Integrate Efforts and Look for Synergies

A key lesson that the Ethiopian government has learned is the need to integrate all their ICT efforts — particularly in the health sector. The health ministry began this process by commissioning a strategic framework for delivering eHealth and mHealth interventions to their population. Though they have yet to implement the strategy, discussions from within the health ministry indicate an ongoing interest from decision-makers to streamline and integrate projects, interventions and organizational efforts. The end objectives are to increase efficiency and expand reach while expending fewer incremental resources.

Refine Underlying Systemic and Organizational Processes

Another lesson the government appears to have grasped is the need to refine the underlying systemic and organizational processes that control operations in the health system before attempting ICT interventions. This approach is exemplified by the health management information system reform, where the government and its partners undertook painstaking reorganization of the paper data collection system before introducing electronic capture and transmission of data. By introducing technology into standardized processes (such as paper-based data collection), ICT becomes a central vehicle for improving how healthcare is received and delivered. Through this process, Ethiopia recognizes that even advanced technology overlaying faulty processes is unlikely to deliver improvements in health system functioning or service delivery, a lesson that many countries have learned only through difficult experiences.

Moving forward, Ethiopia and other African countries would benefit from integrating efforts and improving the processes that will make ICT most useful to the healthcare system. The federal government’s command of national-level initiatives, such as the HEP, allows it to scale programs nationally and build private-sector participation in ICT sectors (as it did by allowing France Telecom to manage Ethio Telecom). This would ultimately benefit the health sector and, as a result, the people of Ethiopia.
## Table 9: Challenge, opportunity, and path to health

<table>
<thead>
<tr>
<th>Health Sector (Micro-level) Challenge</th>
<th>System-wide (Macro-level) Influencer</th>
<th>Impact on Citizens</th>
<th>ICT Opportunity</th>
<th>ICT Challenge</th>
<th>Path to Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding Shortage</td>
<td>Relatively high cost to provide civil services, especially in rural areas</td>
<td>Reduced confidence in leaders’ ability to deliver public services</td>
<td>Reduce costs (mHealth/telemedicine)/increase cross-sector revenues with ICT platform (telco/mMoney)</td>
<td>Insufficient infrastructure (telecom/power)</td>
<td>0.5-1YR: low-cost, preventive interventions; reprioritize health funding in policies and budget</td>
</tr>
<tr>
<td></td>
<td>Limited revenue sources</td>
<td>Residual impact on quality of life</td>
<td></td>
<td></td>
<td>1-SYRS: resolve ICT challenges; high-cost interventions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of economic productivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment and Supplies Shortage</td>
<td>Funding shortage</td>
<td>Service gaps</td>
<td>Deploy real-time ICT to enable urban-rural communication (telemedicine) and mobile-assisted supply chain management (MASCM)</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: target rural providers for low-capacity (mobile) supply chain interventions</td>
</tr>
<tr>
<td></td>
<td>Limited access between urban and rural areas</td>
<td>More deaths related to &quot;multiple delays&quot;270</td>
<td></td>
<td></td>
<td>1-SYRS: increase rural connectivity, roads transportation, higher-capacity database systems</td>
</tr>
<tr>
<td></td>
<td>Inefficient manual supply chain mgmt. (SCM) processes</td>
<td>Reduced trust levels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health personnel not trained in inventory management</td>
<td>Higher preventable mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insufficient Quantity of Skilled Healthcare Workers</td>
<td>Underfunded skilled education system</td>
<td>Increase in &quot;third delay&quot;-related mortality</td>
<td>Reduce training cost and increase penetration with ICT (broadband, video/IVR/SMS)</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: video broadband group training at urban and rural health centers; low-cost mobile continuing education</td>
</tr>
<tr>
<td></td>
<td>High unemployment</td>
<td>Spread of communicable diseases</td>
<td>Increase rural access to specialized care training with ICT (telemedicine)</td>
<td>Device and service usability for healthcare workers</td>
<td>1-SYRS: increase rural connectivity; improve education system</td>
</tr>
<tr>
<td></td>
<td>&quot;Brain drain&quot;</td>
<td>Loss of economic productivity due to third delay</td>
<td></td>
<td>No proven scalable and sustainable business model</td>
<td></td>
</tr>
<tr>
<td>Population Uneducated About Prevention and Treatment of Preventable Diseases</td>
<td>Underfunded primary and secondary education system</td>
<td>Avoidable high rates of transmission and mortality due to preventable diseases</td>
<td>Radio, TV, and mobile education campaigns promoting disease prevention healthy living</td>
<td>Literacy of rural populace</td>
<td>0.5-1YR: maximize telecom networks for SMS/voice/video training</td>
</tr>
<tr>
<td></td>
<td>Sociocultural norms that encourage misunderstanding of communicable diseases and unhealthy behaviors</td>
<td>Spread of epidemics</td>
<td>Patient reminders improve timing and quality of treatment</td>
<td>Over 80 official languages</td>
<td>1-SYR: improve mobile and broadband connectivity; increase investment in education</td>
</tr>
<tr>
<td>Lack of Health System Infrastructure to Enable Communication Between Rural and Urban Centers</td>
<td>Lack of financial capital to develop and maintain healthcare system</td>
<td>Limited access to proper medical care</td>
<td>Use ICT to maximize community-based health/reduce need for HSI</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: establish broadband VPNs between centers; arm healthcare workers with useful technology; digitize records system</td>
</tr>
<tr>
<td></td>
<td>Health posts are ill-equipped and lack basic electricity</td>
<td>Low levels of trust in healthcare system</td>
<td></td>
<td>Commitment to inefficient data collection process</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limited road infrastructure to reach hospitals or travel to patients</td>
<td>Bad health translates to low economic productivity</td>
<td></td>
<td></td>
<td>1-SYRS: Improve broadband connectivity; maximize telemedicine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mali Case Study

Country Profile

As an ethnically and linguistically diverse country of 13 million people covering vast expanses of the Sahara desert and the Sahel, Mali exemplifies both the ongoing challenges faced by modern African nations and the promise that proactive policy can have in overcoming those challenges. Mali remains a mostly rural, agricultural society, with only 33% of the population living in urban areas. Approximately 10% of the population is nomadic. Poverty remains a major issue despite recent economic gains. As of 2005, 59% of the country was living below the poverty line, increasing to 73% among rural populations. Only 26% of Malian adults are literate, and there are both cultural and socioeconomic differences within and between inhabitants of farming communities near the Niger River and nomadic peoples in the desert areas of the north. While Mali struggles with food insecurity due to desertification and rapid population growth, as well as inefficient agricultural practices, its commitment to multi-party democracy has won it plaudits from its major aid and trading partners. Mali derives about two-thirds of its US$150 million health budget from aid donors including the U.S. and France.

Health Profile

Figure 22: Health profile. Source: WHO World Health Data Repository

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Expectancy at Birth</td>
<td>53</td>
</tr>
<tr>
<td>Under-5 Mortality Rate (2009)</td>
<td>191 per 1000</td>
</tr>
<tr>
<td>Maternal Mortality (2009)</td>
<td>830 per 100,000</td>
</tr>
<tr>
<td>Prevalence of Tuberculosis (2009)</td>
<td>628 per 100,000</td>
</tr>
<tr>
<td>Per Capita Expenditure on Health (2009)</td>
<td>US$38</td>
</tr>
<tr>
<td>Expenditure on Health as % of GDP (2009)</td>
<td>5.6%</td>
</tr>
<tr>
<td>Births attended by Skilled Health Personnel (2006)</td>
<td>49%</td>
</tr>
<tr>
<td>Rural Births Attended by Skilled Health Personnel (2006)</td>
<td>38%</td>
</tr>
<tr>
<td>Physicians (2008)</td>
<td>0.49 per 10,000</td>
</tr>
<tr>
<td>Nurses/Midwives (2008)</td>
<td>2.97 per 10,000</td>
</tr>
<tr>
<td>Hospital Beds (2009)</td>
<td>0.5 per 10,000</td>
</tr>
<tr>
<td>Major causes of Death for Children Under-5:</td>
<td>Diarrhea, Pneumonia, Malaria &amp; Prematurity</td>
</tr>
</tbody>
</table>

The major health challenges facing Mali are child and maternal mortality, and mortality due to preventable diseases such as malaria. Despite recent improvements, Mali’s child and maternal mortality rates are among the highest in the world; nearly one out of every five children dies before their fifth birthday and one in twenty women dies due to pregnancy or childbirth. Child mortality is even worse in rural areas, where 23.4% of children die before their fifth birthday, versus 15.8% in urban areas (2006). The main causes for this state of affairs are a lack of skilled health professionals, improperly equipped medical facilities, particularly in rural areas, the prohibitive cost of medical care, and a lack of public funding. Fifty-three percent of women say they cannot afford necessary
medications and that money is the main obstacle preventing them from accessing medical care. While the prevalence of HIV/AIDS is not as high in Mali as it is in other African nations, lack of public knowledge about the disease leaves it in danger of spreading. As of 2006, only 22% of men and 18% of women ages 15-24 have comprehensive correct knowledge of HIV/AIDS. Over 1.6 million cases of malaria were reported in Mali in 2009, and malaria was responsible for 16% of under-five deaths in 2008.

**Progress towards the MDGs**

<table>
<thead>
<tr>
<th>Table 10: Progress towards the MDGs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 4: Reduce Child Mortality</strong></td>
</tr>
<tr>
<td>Year</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Under 5 Mortality Rate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Goal 5: Improve Maternal Health</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Maternal Mortality Ratio per 100,000 Live Births</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2006</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of births attended by skilled health personnel</td>
<td>40.6</td>
<td>49</td>
<td>20.69%</td>
</tr>
<tr>
<td>Antenatal Care coverage, at least one visit, percentage</td>
<td>56.8</td>
<td>70.4</td>
<td>23.94%</td>
</tr>
<tr>
<td>Antenatal Care coverage, at least four visits, percentage</td>
<td>29.9</td>
<td>35.4</td>
<td>18.39%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Goal 6: Combat HIV/AIDS, Malaria and Other Diseases</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>People living with HIV, 15-49 years old, percentage</td>
</tr>
<tr>
<td>Prevalence of Tuberculosis per 100,000</td>
</tr>
</tbody>
</table>

**Healthcare Policy and Strategy**

According to the Malian Ministry of Health’s Strategic Plan, the country’s key health goals are to improve access and quality of healthcare, further develop telemedicine, increase the number of trained healthcare workers, develop high-impact projects that will help to achieve the MDGs and address the lack of social protections. A variety of initiatives are already underway. The Ministry of Health is trying to maximize the number of people living within 5km of a health facility through the creation of new community health centers. They also offer better employment conditions to healthcare workers willing to work in areas with a high need. The Free Cesarean Section Initiative allows women to receive government-funded cesarean sections at public hospitals, health clinics and army clinics. This intervention has been associated with an increase institutional births and a decrease in maternal and neonatal
Furthermore, the Malian Ministry of Health has recently partnered with the Ministerial Leadership Initiative to pursue a community-based health insurance program, which is scheduled to pilot shortly.  

**ICT Infrastructure**

Figure 23: ICT infrastructure. Sources: ITU, Mobileactive.org

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Phone Subscribers (2010)</td>
<td>476.6 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Fixed Line Subscribers (2010)</td>
<td>0.74 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Ratio of Mobile Phones to Fixed Line Subscribers (2010)</td>
<td>64:1</td>
</tr>
<tr>
<td>Internet Users (2010)</td>
<td>27.0 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Fixed Internet Subscribers (2010)</td>
<td>1.3 per 1,000 inhabitants</td>
</tr>
<tr>
<td>Mobile Off-Network Call Price for 1-minute local (2006)</td>
<td>US$0.45</td>
</tr>
<tr>
<td>Mobile On-Network Call Price for 1-minute local (2006)</td>
<td>US$0.20</td>
</tr>
<tr>
<td>Price of one SMS (2006)</td>
<td>US$0.10</td>
</tr>
<tr>
<td>Mobile Providers</td>
<td>Malitel, Orange Mali</td>
</tr>
</tbody>
</table>

The telecommunications sector is booming in Mali, with mobile penetration and accessibility increasing and the cost of airtime dropping. The cost of airtime is now lower in Mali than in most other stable low-income nations, contributing to an increase in customer satisfaction. Mali is a member of the West Africa Telecommunications Regulators Association (WATRA) which has contributed to the low cost of service and roaming charges that are among the lowest in the region.  

In 2000, there was less than 1 mobile subscription per 1000 inhabitants. By 2009, this had increased to 300 per 1000 inhabitants, and 476 per 1000 in 2010 – an increase of nearly 60% in one year. Fixed Internet subscriptions remain low, with only 2.7% of inhabitants considered Internet users (compared to 9.6% for Africa as a whole). Only 0.13% of the population has a fixed Internet subscription, though many Malians access the Internet from public locations such as cyber cafés. By 2008, telecommunications revenue had reached 5.2% of GDP and over US$93 million was being invested in the telecommunications industry annually. As of 2008, only 22% of the country lived in areas with GSM coverage.

The mobile communications industry is dominated by two major players: Under the holding group Sotelma, Malitel is the national telecom company, formerly state-run, that has since been privatized and sold to Maroc Telecom. The government maintained a 20% stake in Sotelma, while The Moroccan Telecommunications Group purchased 51%, employees own 10%, and the public owns 19%. Orange Mali is the second operator. A third license was in the approval process as of June 2011. The Internet service provider (ISP) industry was highly fractured with over 20 ISPs by 2008, though in recent years the number has fallen to 5 due to predatory pricing policies. Mali is part of the Economic Community of West African States (ECOWAS), which seeks to integrate the region’s economic activities, including telecommunications, transportation and energy.

**Enabling Infrastructure**

**Power:** Power is the most significant infrastructural problem facing Mali today. The cost of producing electricity is higher than in most other developing countries. Though a program for rural electrification named AMADER was implemented, it is economically problematic to expand access in rural areas. By 2009, only 17% of the country had access to electricity.
Roads: Mali has a significantly lower road density than most other low-income countries, and much of the northeastern desert regions are not accessible by road. In 2009, only 14% of the rural population lived within 2km of all-season roads. That being said, Mali has focused more on maintaining regional road arteries in order to better facilitate business and access to sea ports in neighboring countries. Nearly all regional roads are paved and 90% are in good or fair condition. Only 20% of businesses in 2009 identified roads as a constraint for doing business, much lower than the regional average.

eHealth

Mali currently has many programs implementing ICT for health purposes. These programs have been initiated by the Ministry of Health, foundations, NGOs and international eHealth partnerships. We will look closely at the IKON Tele-radiology and Pesinet programs later in the chapter, but several other programs (many in the pilot or planning stages) are worth mentioning. The RAFT network case study can be found in the appendix.

- The National Agency for Tele-health and Paperless Medicine (ANTIM) has been created.
- An upcoming e-administration intranet system will connect all ministries.
- CATEL is a portal that facilitates communication between francophone tele-health workers.
- Keneya Blown is a website that hosts online continuing education for medical profession and a health information portal for professionals and the general public.
- PatientView provides small health clinics with the ability to collect and maintain a patient record database accessible via mobile phone. It is in the Community Health Center of Sikoro-Sourakabougou.
- DHIS2 is a free open source platform that allows for the collection and analysis of data for planning and decision making at the national level.
- Cyberpharma is an online database of pharmacists throughout the country.
- Flotte de Mobile would create a fleet of mobile phones allowing health workers in the field to contact each other and submit and access patient information databases.
- OpenClinic is a digital hospital information system allowing hospitals to maintain a database of patient records.
- IKON Tele-radiology allows physicians in regional hospitals to digitally send x-rays to specialists in Bamako for diagnosis. (For more information see the case study below.)
- RAFT network is a digital network connecting health professionals in Francophone Africa with each other and with specialists in Europe. The network provides webcasting of interactive courses, tele-consultations, collaborative knowledge base development and the evaluation of telemedicine programs in rural areas.
- Pesinet is a NGO run program where healthcare workers visit the homes of children under the age of 5 on a weekly basis looking for symptoms of disease and entering vital statistics into a database via mobile phone. If any irregularities are found, the child is referred to a doctor and treated.
Macro-level Challenges and Opportunities

Human Capital
Mali has a serious deficit of human capital. Literacy rates were still low (26% of adults) in 2009, but primary education enrollment rates have increased to 74% (79% for boys and 69.5% for girls). Secondary and tertiary enrollment rates are low and there are few training facilities outside the capital. The lack of rural education is an especially serious problem considering that only 33% of Malians live in urban areas. Brain drain affects Mali as well; by 2000, 23% of Malian-born doctors were working abroad.

Organizational Issues
Mali has been a democracy since 1992, when it transitioned from the one-party socialist regime that had ruled the country since its independence from France in 1960. Mali is split into eight districts, and thanks to decentralization efforts immediately following democratization, regions, districts and townships have some level of decision-making power and financial control over their territories. This level of decentralization has allowed regional hospitals to pursue their own programs and eHealth initiatives, such as the Community Health Center of Sikoro-Sourakabougou, but may complicate local infrastructure-building efforts by requiring consultation with multiple levels of government.

Process Considerations
While most bureaucratic paperwork was previously done by hand, the government in Mali is attempting to streamline these processes through the use of technology. A project is currently under way to create a government intranet (e-administration) system that would connect all ministries in order to better facilitate operations and planning, particularly in the areas of budgeting and finance.

Regulatory Concerns
Despite some recent improvements, Mali’s regulatory environment is not conducive to private sector growth and entrepreneurship. Mali’s lack of an efficient legal and regulatory environment, weak financial sector and notoriously corrupt judicial system impede investment and innovation. The government has privatized many major state-run enterprises, including the telecommunication sector, since completing an agreement with the World Bank and the IMF in 1988. Many prices, including telecommunications, oil and cotton, are regulated by the government.

Inadequate Social Safety Net
In 2010, the Malian government spent approximately 0.5% of GDP on social security programs – an insufficient amount given the high levels of poverty and food insecurity in the country. Many of the social programs are not targeted to the poorest of the poor, and the government pension and healthcare system is available only to civil servants and formal sector employees. Select social programs (such as cash transfers and public works for food) exist to alleviate severe economic shocks, but most are short-term and insufficient to tackle chronic poverty.
Health Sector Challenges and Opportunities for ICT

Funding Shortage

Annual per capita health expenditure was only US$38.42 in 2009, though this is a 159% increase since 1995. It may be difficult for this to increase too dramatically in the short term, as health expenditures account for 5.6% of GDP, which is on par with many other developing nations. Most Malians cannot afford healthcare and only 2.4% of the country had health insurance in 2010. In the Ministry of Health’s latest strategic plan, creating a functional system of health insurance is a priority. The system may include mandatory insurance, a healthcare assistance fund, risk and agriculture insurance, and partnerships between the government, private sector, NGOs and donors to better improve the delivery of healthcare. The state has attempted to improve access to medicine by issuing decrees that limit the price the private sector can charge for medicine, but high levels of poverty make even discounted medication inaccessible to most Malians. In 2008, 53% of women surveyed said that they cannot afford necessary medications, and that money is the main obstacle preventing them from accessing medical care. This is even higher among rural women than urban (59% and 40% respectively).

Figure 24: Opportunity and challenges for funding shortage

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ICT can be used to ensure that precious healthcare expenditures are used optimally by either focusing on low-cost preventative interventions or by ensuring efficient delivery of medications to prevent waste.</td>
<td>• Poor infrastructure, particularly in rural areas (connectivity, electricity)</td>
</tr>
<tr>
<td>• An example of a program for low-cost preventative measures in Mali is Pesinet (see case study in appendix)</td>
<td>• Low literacy rates</td>
</tr>
</tbody>
</table>

Equipment and Supplies Shortage

Inefficient supply chain management causes low availability of necessary pharmaceuticals and medical supplies, including ART medication and contraceptives. Mali needs a coherent supply management system, particularly for the distribution of vaccinations and medicine that require climate control and proper storage techniques.

Figure 25: Opportunity and challenges for equipment and supplies shortage

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Digital supply chain management program such as SMS for Life</td>
<td>• Poor infrastructure, particularly in rural areas (connectivity, electricity)</td>
</tr>
<tr>
<td></td>
<td>• Low literacy rates</td>
</tr>
</tbody>
</table>

Insufficient Quantity and Quality of Skilled Healthcare Workers

In 2010, there was one doctor per 10,370 inhabitants, one medicine woman per 23,928 inhabitants and one medical assistant/nurse per 4,190 inhabitants. These numbers differ greatly between Bamako and the more rural areas, where there is only one doctor per 25,664 people and one nurse per 12,767. Only 35% of expectant mothers received at least four visits of antenatal care in 2006, and only 49% of births are attended by skilled health professionals. This number also varies significantly between rural and urban areas, with only 38% of rural births being attended by skilled health personnel versus 80% in urban areas (2006). According to the
health ministry’s Strategic Plan, the government is making a concerted effort to increase the number of trained health professionals by aggressively recruiting for health education programs and encouraging the proliferation of private schools offering health certifications. Between 2005 and 2007, 3,070 health technicians graduated from public and private schools.323

Figure 26: Opportunity and challenges for insufficient quantity and quality of healthcare workers

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| • Mali promotes telemedicine campaigns, such as IKON Tele-radiology, as well as continuing education programs for healthcare professionals via webinars and conferences in Keneya Blown and the RAFT network.324 | • Limited Internet connectivity, particularly in rural areas
|                                                                            | • Reliable electricity reaches less than 20% of the country |

**Population Uneducated About Prevention and Treatment of Preventable Diseases**

Public knowledge about the prevention and treatment of communicable diseases is still a problem, with only 17.9% of women and 22.2% of men ages 15-24 having complete and correct knowledge of HIV/AIDS in 2006.325 According to a WHO study conducted from 2000 to 2009, only 12% of men and 8% of women ages 15-49 use condoms during higher-risk sex.326 While Keneya Blown offers a public health education portal that could help educate the public about healthy practices and the prevention communicable diseases, Mali’s low level of Internet penetration makes this site inaccessible to most Malians.

Figure 27: Opportunity and challenges for prevention and treatment

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| • There is an opportunity for an informational campaign to increase awareness about communicable diseases, such as the Wegen AIDS talkline in Ethiopia. | • Somewhat low (but growing) mobile penetration
| • The Keneya Blown website provides public health information, but given the low literacy and Internet penetration rates, voice-related interventions would have the highest impact. | • Low literacy
|                                                                            | • Limited Internet penetration |
Table 11: Health sector challenges

<table>
<thead>
<tr>
<th>Health Sector (micro-level) Challenges</th>
<th>Systemic (macro-level) Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Constraints</td>
</tr>
<tr>
<td>1 Funding Shortage</td>
<td>X</td>
</tr>
<tr>
<td>2 Equipment and Supplies Shortage</td>
<td>X</td>
</tr>
<tr>
<td>3 Insufficient Quantity of Skilled Healthcare Workers</td>
<td>X</td>
</tr>
<tr>
<td>4 Population Uneducated About Prevention and Treatment of Preventable Diseases</td>
<td>X</td>
</tr>
<tr>
<td>5 Lack of Health System Infrastructure to Enable Communication Between Rural and Urban Centers</td>
<td>X</td>
</tr>
</tbody>
</table>

Lack of Health System Infrastructure and Rural-Urban Communication

Mali’s health infrastructure is insufficient to meet the demands of its people. As of 2010, the country had only 11 hospitals and 59 secondary care centers. The main service delivery points are the Community Health Centers. There are 873 centers around the country, but they are insufficiently funded and the cost of service at these facilities is often prohibitive, causing them to be underutilized. The quality of service and supplies at these facilities varies dramatically, as well. The quality of the telecommunications infrastructure has improved in recent years, but lack of coverage in rural areas inhibits rural-urban communication.

Figure 28: Opportunity and challenges for infrastructure and communication

- The health infrastructure and communication between rural and urban areas can be further developed by strengthening tele-health programs, the e-administration intranet and various practitioner networks including RAFT, Keneya Blown and CATEL.
- Additionally, the use of data collection software packages such as DHIS2 and OpenClinic should better facilitate the exchange of information and data between rural and urban centers.
- Limited Internet connectivity
- Weak infrastructure, particularly electricity in rural areas.
**Figure 29: IKON Tele-radiology**

<table>
<thead>
<tr>
<th>Name: IKON Tele-radiology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application Area:</strong> Telemedicine</td>
</tr>
<tr>
<td><strong>Date Started:</strong> 2005</td>
</tr>
<tr>
<td><strong>Sponsoring Organization and Partners:</strong> SOMIM (<em>Société Malienne d’Imagerie Médicale</em>), IICD (Dutch International Institute for Communication and Development); will be gradually integrated into the Malian Ministry of Health</td>
</tr>
<tr>
<td><strong>Locations:</strong> Bamako, Timbuktu, Mopti, Sikasso, Kayes, Gao and Kidal</td>
</tr>
<tr>
<td><strong>Scope:</strong> At the end of the pilot phase in 2006, each hospital was sending approximately 30 x-rays per month to Bamako for second opinions, over 70% of which had an urgent need.</td>
</tr>
<tr>
<td><strong>Target Market:</strong> Provincial and Regional Hospitals</td>
</tr>
<tr>
<td><strong>Micro-Level Challenge Addressed:</strong> Lack of Health System Infrastructure to Enable Communication Between Rural and Urban Centers, Insufficient Quantity of Skilled Healthcare Workers</td>
</tr>
<tr>
<td><strong>Description:</strong> The IKON project seeks to remedy the problem caused by the centralization of medical specialists in Mali. Nearly all radiologists in Mali are located in the capital of Bamako, and 50% of X-rays read by general physicians are misinterpreted. IKON allows physicians in regional hospitals to send X-rays and consult with specialists in the capital in order to improve the quality of their diagnoses and prevent patients from needing to travel to Bamako to meet with a specialist. X-rays are taken and developed at the regional locations. They are then scanned and sent electronically to radiologists in the Bamako hospital. Radiologists in Bamako review the X-rays and reply with a diagnosis within 24 hours. If necessary, radiologists in Bamako can consult with European specialists as well.</td>
</tr>
<tr>
<td><strong>How it works:</strong> IKON is a partnership between the International Institute for Communication and Development (IICD), a Dutch non-profit organization, and SOMIM (the Malian Society for Medical Imagery). The idea for IKON came out of a 2002 IICD conference of healthcare stakeholders in Bamako and was turned into a reality by the hard work of SOMIM member Dr. Mahamadou Touré and medical student Romain Rolland Tohouri. IICD provided the funding for the program and assisted with its implementation.</td>
</tr>
<tr>
<td><strong>Efficacy:</strong></td>
</tr>
<tr>
<td><strong>Challenges to Implementation:</strong> Tele-radiology requires not only electricity, computers and Internet connection, but also a high-quality server, radiological equipment and scanners, which are quite costly. Modifications, such as digitalization of X-rays to avoid the need to purchase scanners, are needed to make the program economically sustainable. Users must be properly trained on how to use not only the equipment, but computers and the Internet in general.</td>
</tr>
</tbody>
</table>
Table 12: ICT interventions method and challenges

<table>
<thead>
<tr>
<th>ICT Interventions Method</th>
<th>Sustemic (macro-level) Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Constraints</td>
</tr>
<tr>
<td>1 Digital Health Ecosystem (DHE)</td>
<td>X</td>
</tr>
<tr>
<td>2 SMS</td>
<td>X</td>
</tr>
<tr>
<td>3 IVR</td>
<td>X</td>
</tr>
<tr>
<td>4 Video (telemedicine)</td>
<td>X</td>
</tr>
<tr>
<td>5 Radio</td>
<td>X</td>
</tr>
<tr>
<td>6 TV</td>
<td>X</td>
</tr>
<tr>
<td>7 HMIS</td>
<td>X</td>
</tr>
</tbody>
</table>

Lessons from Mali

Though it does not attract international media attention, Mali provides an example of a low-income country with extraordinary health challenges that has acknowledged the value of ICT and is attempting to expand its technological capacity on a limited healthcare budget. Mali has recently adopted many of the short-term interventions recommended in the previous chapter in the fields of telemedicine, distance learning, remote data collection and healthcare worker communication.

Use ICT to Realize Efficiency and Combat Waste

Telemedicine is being used to overcome the lack of trained healthcare workers and specialists in rural areas (e.g., IKON Tele-radiology), digital distance learning tools are being used to improve healthcare worker training and efficacy (RAFT network, CATEL and Keneya Blown), and open-source digital medical record systems are being used to develop e-administration systems, further improving efficiency and combating waste. The upcoming Flotte de Mobile program will further improve healthcare worker communication and allow for remote data collection.

Partnerships Increase Access to Expertise, Funding and ICT

The programs in Mali result from a wide range of partnerships which increase access to expertise, funding and ICT options. Some of these programs, such as the adoption of an e-administration system, are government initiatives. Others, such as Pesinet, have been developed by NGOs with the blessing and potential future involvement of the government, within a public-private partnership (PPP) framework. The Flotte de Mobile program is the result of such a PPP that involves the Ministry of Health, the mHealth Alliance, the Orange Foundation and the Rockefeller Foundation. Similarly, IKON Tele-radiology and Keneya Blown grew out of partnerships between an NGO (IICD) and groups of Malian medical professionals. These programs illustrate how the healthcare private sector can optimize local resources through coordinated efforts with government. The decentralized nature of the country also allows regional and community healthcare centers to independently experiment with interventions, creating an environment conducive to innovation and partnerships with NGOs.
Figure 30: Pesinet

Name: Pesinet

Application Area: Patient Monitoring and Referral

Date Started: 2009 (Pilot Phase)

Sponsoring Organization and Partners: Pesinet, a non-profit organization, Ashoka, Sanofi Espoir Foundation, Orange Mali Foundation, BNP Paribas, Alcatel-Lucent Foundation, Medex, the Ministry of Health, Network of Community Health Care Centers, the National Federation of Community Health Associations

Locations: Bamako

Scope: Pilot located in Bamako’s Coura district with 600 subscribing children

Target Market: Children under the age of 5

Micro-Level Challenges Addressed: Funding shortage; Population uneducated about preventable diseases

Description: Healthcare workers visit children in their homes each week to collect basic information and look for early symptoms of disease, including fever, vomiting, diarrhea, coughing and weight loss. The data is entered into a Java-based application on a mobile phone and sent via GPRS (or SMS if GPRS is unavailable) to a central server which flags abnormal cases and generates medical records accessible by physicians in the affiliated network of community healthcare centers. When abnormalities are detected, children are referred to the nearest partner medical facility. Participants pay approximately US$1 per month for the service, which includes the health worker’s visits, a medical examination at the healthcare center when abnormalities have been identified, and half the price of the child’s essential medication.

How it works: Pesinet is a nonprofit organization headquartered in France with a team of staff working in Mali. Pesinet partners with Community Health Care Centers (CHCCs) and has a Memorandum of Understanding with the Ministry of Health of Mali and has the support of ANTIM for its pilot in Bamako and future expansion in other regions of the country. It also has a national partnership agreement with the National Federation of Community Healthcare Centers

Efficacy: According to an impact assessment study done from September 2010 to July 2011, of the 182 subscribing families, the program has achieved 94% client satisfaction, an efficient detection system (93% of children referred to doctors were sick) and high levels of healthcare use amongst subscribers (one in four subscribing children is seen by a doctor at least once per month).

Challenges to Implementation:

- **Finding the right local partners:** to be sustainable and grow their operations, Pesinet needed to integrate with the network of CHCCs and build relationships with the National Federation of Community Health Associations.

- **Quality of healthcare:** While Pesinet is responsible for the home monitoring system, subscribers receive care at CHCCs where the quality of service can be quite poor. In order to overcome this, Pesinet works to develop the capacity of its partner facilities and is exploring partnerships with health NGOs to improve the quality of care.

- **Lack of awareness of the value of preventative service:** Pesinet has begun holding monthly community meetings educating subscribers about the value of preventative medicine, and early detection.

- **Budgetary sustainability:** Pesinet found that the program is not able be completely self-financing while maintaining affordable, quality care to the poorest of the poor. They are looking into a variety of options including cross-subsidization and partnerships with local and national authorities.

Comments: “Paying for Pesinet is cheaper than when I didn’t have Pesinet for my other children.” “It makes life easier for mothers.” - Pesinet subscribers

“Maliens resort to health care centers only when the disease is already advanced and complications appear. PESINEIT is a means to drive a change in this situation by demonstrating to families that it is less stressful and less expensive to have recourse to the health center as soon as possible” – Cheick Mohamed PANO, Program Supervisor

“We can see that PESINET is a good thing, especially because it increases prevention, which is not enough developed in Mali. ... Subscribing children resort more to the health care center when the disease appear than non-subscribers who usually come to the doctor when the disease is already advanced.” - Dr. Hamadoun Cisse, general practitioner in a partnering health care center.
Need to Adopt More ICT Interventions

Though it has made some promising steps toward a more comprehensive eHealth program, Mali would benefit from adopting more ICT interventions and programs. A mobile-assisted supply chain management system would be useful to prevent waste and stock-outs and improve management of medications, immunizations and insecticide-treated bed nets. Given the lack of access to financial services and insurance, Malians would benefit from mobile-based savings and insurance programs that could be used for basic and emergency health needs. ICT-based public information campaigns such as radio shows, information hotlines and mobile-recorded messages about preventable diseases and healthy practices for expectant mothers and children could vastly improve health education and help reduce mortality rates.

In the long term, Mali will need to address many of the country’s systemic challenges, including improving rural connectivity, roads and healthcare infrastructure, and training capacity. The country will also need to increase its investment in secondary and tertiary education. Such a system should emphasize healthcare with public-private commitment evidenced by a comprehensive medical insurance system.

Table 13: Challenge, opportunity and path to health

<table>
<thead>
<tr>
<th>Health Sector (Micro-level) Challenge</th>
<th>System-wide (Macro-level) Influencer</th>
<th>Impact on Citizens</th>
<th>ICT Opportunity</th>
<th>ICT Challenge</th>
<th>Path to Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding Shortage</td>
<td>Relatively high cost to provide civil services</td>
<td>Reduced confidence in leaders' ability to deliver public services</td>
<td>Reduce costs (health/telemedicine)</td>
<td>Insufficient infrastructure (telecom/power)</td>
<td>0.5-1YR: low-cost, preventive interventions; eliminate wastage</td>
</tr>
<tr>
<td></td>
<td>Limited revenue sources</td>
<td>Residual impact on quality of life</td>
<td>Residual impact on quality of life</td>
<td>Fund health with ICT-assisted savings/revenues</td>
<td>1-5YRS: resolve ICT challenges; develop insurance system</td>
</tr>
<tr>
<td></td>
<td>Lack of access to insurance</td>
<td>High mortality</td>
<td>High mortality</td>
<td>Insufficient infrastructure assets (spectrum) not maximized</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of economic productivity</td>
<td>Reduced trust levels</td>
<td>No cross-sectoral collaboration</td>
<td></td>
</tr>
<tr>
<td>Equipment and Supplies Shortage</td>
<td>Funding shortage</td>
<td>Service gaps</td>
<td>Deploy real-time ICT to enable 1) urban-rural communication (telemedicine) 2) mobile-assisted supply chain management (MASCMA)</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: target rural providers for low-capacity (mobile) supply chain interventions</td>
</tr>
<tr>
<td></td>
<td>Limited access between urban and rural areas</td>
<td>More deaths related to “multiple delays”</td>
<td>Low rural connectivity</td>
<td>1-5YRS: increase rural connectivity, roads transportation; higher-capacity databases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inefficient manual supply chain mgmt. (SCM) processes</td>
<td>Reduced trust levels</td>
<td>Device interoperability</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higher preventable mortality</td>
<td>Inefficient supply chain process</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Commitment of leadership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insufficient Quantity of Skilled Healthcare Workers</td>
<td>Lack of rural training institutes</td>
<td>Lack of access to healthcare workers</td>
<td>Reduce training cost and increase penetration with ICT (broadband, video/IRV/SMS)</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: access increase to tele-radiology &amp; distance training throughout country</td>
</tr>
<tr>
<td></td>
<td>Lack of human capital</td>
<td>Spread of communicable diseases</td>
<td>Increase access to specialized care training with ICT</td>
<td>Device and service usability for healthcare workers</td>
<td>1-5YRS: increase rural training facilities, improve education system, connect community health centers to existing networks</td>
</tr>
<tr>
<td></td>
<td>“Brain drain”</td>
<td>Loss of economic productivity due to third delay</td>
<td>Telemedicine and consultation between rural and urban areas</td>
<td>No proven scalable and sustainable business model</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High maternal and child mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Uneducated About Prevention and Treatment of Preventable Diseases</td>
<td>Underfunded education system</td>
<td>Avoidable high rates of transmission and mortality due to preventable diseases</td>
<td>Reduce ICT to maximize community-based health/reduce need for HSI.</td>
<td>Literacy of populace</td>
<td>0.5-1YR: maximize telecom networks for SMS/voice/video training</td>
</tr>
<tr>
<td></td>
<td>Sociocultural norms cause misunderstanding of communicable diseases and unhealthy behaviors</td>
<td>Spread of epidemics</td>
<td>Complete patient records database</td>
<td>Mobile phone ownership</td>
<td>1-5YRS: improve mobile and broadband connectivity; increase education investment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implement VPNs and interconnect rural-urban health centers</td>
<td>Cultural norms</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commitment of leadership</td>
<td></td>
</tr>
<tr>
<td>Lack of Health System Infrastructure to Enable Communication Between Rural and Urban Centers</td>
<td>Lack of capital to develop and maintain health system</td>
<td>Limited access to proper medical care</td>
<td>Use ICT to maximize community-based health/reduce need for HSI.</td>
<td>Low rural connectivity</td>
<td>0.5-1YR: establish broadband VPNs between centers; arm healthcare workers with useful technology; digitize records system</td>
</tr>
<tr>
<td></td>
<td>Inadequate rural connectivity due to licensing regimes, rapid payback models and reduced ROI for operators</td>
<td>Low levels of trust in healthcare system</td>
<td>Complete patient records database</td>
<td>1-5YRS: Improve broadband connectivity; maximize telemedicine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High maternal and child mortality</td>
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<td>Implement VPNs and interconnect rural-urban health centers</td>
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Chapter 5: Strategy Development and Mainstreaming eHealth

Introduction

The first four chapters of this report offer a situation analysis and case studies of the eHealth landscape, highlighting mHealth, telemedicine and eLearning programs both globally and on the African continent, and diving deeper into the country-specific contexts of Ethiopia and Mali. The chapters analyze the opportunities that systemic (macro) and health system-specific (micro) challenges present for ICT interventions. The findings presented here make it clear that, whether in mHealth, telemedicine or eLearning, the degree to which an eHealth service can be effectively established and provided is often dependent on the complexity of the system being implemented in relation to the enabling in-country environment.

According to a WHO Global Observatory for eHealth (GOe) survey, 114 countries filled out at least one section of the survey as of 2009. Of this group, 112 countries, representing 57% of WHO member countries and 83% of the global population, completed the survey. Within the group, 83% identified at least one mHealth program and 33% identified at least one telemedicine program in their country. Unsurprisingly, high-income countries, which have the most advanced enabling environment, are more likely to have fully established, institutional eHealth programs than are upper-middle, lower-middle and low-income countries. These high-income countries are classified as Phase 4 and 5 countries within the health sector development framework described in Chapter 1. In contrast, the 31 African countries that responded to the survey and their lower-income counterparts were the least likely to have established, institutional eHealth programs in mHealth, telemedicine or eLearning. These countries are in Phase 1, 2 or 3 of health sector development. When eHealth programs exist, they are in either the pilot or informal stages of development due, in part, to some of the macro and micro challenges discussed in Chapter 3. Yet it is encouraging that over 67% of the 46 African countries that are WHO members responded to the survey—a response rate only slightly lower than South-East Asia (73%) and Europe (68%). This indicates a willingness or eagerness to “mainstream” eHealth as a cost-cutting and life-saving tool.

Overview of eHealth Strategy Development

Though a majority of responding countries report that they have developed a policy framework for mHealth (56%) and telemedicine (63%), interventions are generally neither systematic nor fully strategic. Typically, there is a lack of emphasis on 1) creating an enabling environment, 2) amplifying collaboration between critical stakeholders, and 3) exploring effective combinations of interventions. The enabling environment includes scalable and appropriate infrastructure, transparent processes, fair legal frameworks, rules and standards for ICT component interoperability, and incentivizing policies. Stakeholder collaborations involving end-users, government (cross-sector), civil society (including donors), private sector and academia could accelerate understanding and success of interventions. And a well-designed mix of mHealth, telemedicine and eLearning could help a country create synergies and avoid redundancies.

Thus, a holistic strategy that develops an enabling environment, facilitates the collaboration of stakeholders and properly designs the intervention mix is one in which an eHealth systems would thrive. The resulting products and services would improve system resource allocation, reduce delays to care, improve continuity of care, improve health worker skills and make ICT a useful, reliable tool for health workers.
Some countries are developing or have developed their national policies as roadmaps to a national strategy. While 85% have adopted eGovernment policies, 55% have adopted an eHealth strategy. Fewer still (25%, including Peru, Norway, Malaysia, Botswana and Brazil) have established national telemedicine policies, essentially confirming the central role they want eHealth to play in their national health systems development. In fact, Botswana, Malaysia and Norway stand out as three countries that have not only developed national eGovernment, eHealth and telemedicine policies, but have also created national ICT procurement and multiculturalism policies for the health sector (including eHealth). This comprehensive strategy is something that many advanced nations, including the U.S., Canada and France, have not yet formulated.

**Trends in eHealth Strategy Implementation**

The overriding global trend is to establish a national eHealth policy and strategy that is independent of ICT initiatives in other sectors. Generally, the eHealth strategy focuses on 1) deploying a national health management information system (HMIS), 2) re-organizing health record keeping within the public-sector, 3) permitting public-sector deployments of telemedicine, eLearning and mHealth interventions, and 4) permitting public-private collaborations and private-sector providers to combine and leverage the national HMIS network with private communication infrastructure.

The rationale for establishing an HMIS foundation is the understanding that it enables countries to collect, organize, process and disseminate data while protecting individual identification and personalizing records and files. However, there is overwhelming anecdotal evidence in the developmental community that countries are neither realizing all these capabilities nor exploiting the full potential of their HMIS.

In an attempt to guarantee universal healthcare for their residents, most countries have gravitated towards national health programs, some of which have significant eHealth components. The mix between the various components needed for a successful eHealth system have yet to be standardized. Thus, when considering the three categories of eHealth—mHealth, telemedicine, and eLearning—a country’s strategy may be determined by its focus and its position between the vertical and horizontal axes illustrated within Figure 33.

**Vertical Focus**

Similar to the dials on a sound system equalizer, each eHealth intervention category—mHealth, telemedicine, eLearning—occupies its own vertical axis upon which it can slide up or down. The level to which the intervention category slides up or down depends on its role within a country’s eHealth strategy. A country such as Ethiopia, for example, shows evidence of all three intervention categories at low levels as a result of its existing government broadband infrastructure. However, mHealth has assumed a more significant role based on its affordability, implementation speed and interest shown by both public- and private-sector participants who...
are working to improve maternal and child health. Ghana appears to have placed mHealth at the center of their eHealth strategy with the Ghana Health Service (GHS) accentuating such projects as MOTECH and the SENA PDA Project as early as 2004. Vertical focus can be heavily influenced by income level and funding sources. As a result, many low-income Phase 1 and 2 nations that depend on donor funds focus on mHealth interventions, partly because mobile networks increase penetration within their countries for a lower cost, and partly because mHealth is a priority area for their donors. Uganda, Mali, Rwanda, Namibia and Chad are but a few countries that exemplify this trend.

This trend suggests that, because donors generally do not spend funds in low-income countries for projects that require capital-intensive broadband infrastructure, African countries that continue to depend on donor funds may be limited in the kinds of eHealth interventions they can implement. The trend also suggests a need for regional pooling of infrastructure and financial and human resources that can collectively increase their ability to concentrate on these vertical interventions. This effort can be further extended with Community-based Health Financing (CHF), private investments and public-private partnerships, as Lesotho did with a US$100 million, 425-bed hospital.

Phase 4 and 5, upper-income nations such as Singapore, France, the United States and Australia, in contrast, have a greater choice of interventions because they control their funding sources. Those sources are both public and private, but more importantly they are derived from established financial mechanisms such as health insurance, Medicare and social security, which can reduce both individual and group financial risks.

**Horizontal Preparedness**

The research presented in this and other studies indicates a relationship between horizontal preparedness, the degree and mix of eHealth interventions, the quality of health care provision and the general wellness of residents. The advancement and mix of eHealth interventions usually correlates directly with the cohesiveness of the country’s infrastructure, identity and information management systems, and its financial and human resources. As illustrated in Figure 33, these attributes slide back and forth upon the horizontal axis based on the maturity and mix of these attributes within a country.

Attribute maturity also determines the degree and mix of eHealth interventions available within a country. Thus, many Phase 4 and 5, upper-income countries with greater horizontal preparedness—multiple financial pillars (domestic public- and private-sector donors and financiers) as well as the broadband infrastructure to support simultaneous development and deployment of interactive health systems—tend to exhibit a greater degree and mix of eHealth interventions.

In a supportive circular relationship (Figure 34), the vertical focus of a country’s eHealth system should be enabled by the extensiveness of its horizontal preparedness. Thus, the components of a country’s situation analysis should inform the vertical focus as much as the country’s eHealth needs should influence its asset investments. Ultimately, the relationship between these four dimensions—situation, needs, assets and focus—is not linear; it is dynamic.

![Figure 32: eHealth circular relationship](image-url)
The political leadership’s commitment to an eHealth agenda can either stimulate or discourage this symbiotic interaction. For this reason, a country is not doomed because it lacks the institutional assets that other countries have. And a country with a high level of preparedness is not guaranteed to have succeeded in creating a comprehensive eHealth system. Consider that a high-income country, such as the United States, with exceptional institutional assets, might be horizontally prepared but unable to achieve vertical success due to a lack of political coordination in the area of eHealth. Conversely, a low-income country such as Rwanda might achieve more vertical focus, proportionally, as a result of the leadership’s commitment to maximizing mobile telecom assets and donors’ support to drive mHealth. Because all four dimensions are related, a country should not consider them separately when developing a strategy to use eHealth to drive its health sector development from Phases 1 and 2 to Phases 3 and 4.

**eHealth Strategies of Leading Countries**

While 55% of countries surveyed by the GOe have developed a national eHealth policy, few have established or implemented an eHealth strategy. However, Australia, Rwanda, Malaysia and Belize have been profiled extensively for their eHealth strategies that focus in particular on strengthened HMIS systems.

**Australia**

With a 2010 estimated per capita GDP of $41,000, Australia is an example of an upper-income country that is implementing an eHealth strategy based on horizontal preparedness and supported by additional domestic public- and private-sector investments. These investments will allow the country to simultaneously pursue all vertical eHealth categories to a high degree. Developed in 2008 by consulting firm Deloitte, this strategy is anchored on the success of its extensive electronic health management information system (eHMIS)—the core of its eHealth program. The eHMIS system was implemented to cut costs, increase reliability and guarantee confidentiality. Subscribing to the tenets of the International Society for Telemedicine and eHealth, Australia has been converting its existing paper-based health information systems (for medications, test results, scans, hospital discharge reports, referrals and prescriptions) to eHMIS. According to the National e-Health Transition Authority, “Many clinical communications, such as referrals and prescriptions, are still completed on paper. eHealth should improve the quality and safety of the healthcare system and return at least $A2 for every $A1 invested.”

At the center of the Australian national eHMIS initiative is the personally controlled electronic health record (PCEHR)—a databank system that will be managed by a private group called Medibank. This system, which adheres to Australia’s stringent health record privacy laws, has at its core the idea that the individual will have access and decision-making power regarding their health care information. The system will also specify whether the information sits at the local, state or national repository, based on the level of authorization provided by the customer.

One of the biggest innovations of Australia’s strategy is that eHealth development leverages a nationwide broadband network, which establishes standards and extends access to all citizens, particularly those in isolated regions. The principles of patient control over health information and strong ICT infrastructure have led donors and other countries to view Australia’s eHealth deployment as a model with the potential to scale.
Rwanda

In contrast to Australia’s OECD status, Rwanda is a low-income country that depends on foreign donations to meet its healthcare costs and execute its eHealth strategy with a vertical focus on mHealth. In fact, about 50% of its US$32 per capita expenditure on healthcare is provided by donors, mostly by the United States government and the Global Fund to Fight AIDS, Tuberculosis and Malaria. Yet, with over 400 health centers, 42 district hospitals and over 45,000 community healthcare workers, Rwanda has proceeded boldly with an eHealth vision anchored upon an insurance system that covers 92% of its inhabitants.

Key to its strategy are several HMISs which are meant to provide general practitioners and patients in Rwanda access to critical information to prevent illnesses such as malaria and tuberculosis and avoid chronic conditions such as cardiovascular diseases, cancer and diabetes. The components of Rwanda’s HMIS, covered in depth in a Bill & Melinda Gates Foundation/Vital Wave Consulting landscape analysis of Health Information Systems in developing countries, are summarized below:

- The driver of the HMIS is the Système d’Information Sanitaire (SIS, or Health Information System), the country’s national health data core that governs information exchange within the health system.
- This national repository is fed by district-level data that originate from hand-recorded local data that is digitized and aggregated on GESIS (Gestion du Système d’Information Sanitaire).
- Data exchange is then made possible by TRACnet, a mobile, web-based, voice-enabled tracking and reporting system used in approximately 100 clinics that catalogs indicators related to HIV/AIDS. General practitioners are able to use this system to receive and send data once it has been converted from its original paper format.
- The data aggregation and exchange is supported by specialized database and efficiency systems. Quantimed is a Rwandan drugs logistics system, and OpenMRS is a resource management system implemented by Partners in Health. FUCHIA, a tuberculosis database, is implemented by Médecins sans Frontières, and a donor’s database is maintained by CNLS (Conseil National de Lutte contre le SIDA, or the National Council of the Fight Against AIDS).

One of the most striking features of Rwanda’s eHealth program is the influence that the donor community has on the overall strategy, which focuses on the creation of a national HMIS. While the involvement of so many donors has allowed a number of important eHealth initiatives to move forward, the variety of programs has created issues of interoperability. Whereas Australia has maintained the freedom to create a universal strategy based on a cohesive HMIS, the fragmented implementation of Rwanda’s universal strategy is evidence of its low-income status, inadequate horizontal preparedness and dependence on non-domestic donor funds.
Malaysia

Malaysia is a multi-cultural and multi-ethnic country that has been restructuring its health services environment for the last five years. The country, with a population of 27 million, is now considered one of the top five destinations for medical tourism, indicating the competitiveness of at least part of the Malaysian healthcare system. This is in part the result of reforms implemented by the Ministry of Health, starting with the creation of the Malaysian Healthcare Travel Council (MHTC).349

The thrust of the country’s eHealth strategy is to use ICT to provide OECD-standard services for health tourists at one-fifth the cost of such services in developed countries. (For example, an angioplasty that costs US$57,000 in the United States and US$13,000 in Thailand would cost only US$11,000 in Malaysia.350) The country would then leverage the resulting horizontal attributes such as infrastructure, HMIS and financial and human resources to achieve universal coverage in-country. In-country coverage is enhanced by a committed rollout of telecommunication and ICT infrastructure to enable a HMIS that increases the speed and reliability of general practitioner and patient communication. Health tourism includes diagnostic and surgical services, which are further monitored through existing tele-health assets.

As an upper-middle income country, Malaysia’s horizontal preparedness enables it to cohesively deploy multiple vertical health solutions at the national level. The key to their achievements is establishing an extensive infrastructure network to enable internal and external service scale without increasing costs.

Belize

Belize’s eHealth strategy is also focused on information collection, aggregation and exchange made possible by their national system, the Belize HMIS. The system captures over 80% of the health transactions that occur in metropolitan areas (and many rural areas) to serve their population of 300,000. It is considered one of the most comprehensive implementations in the world. Much like Australia, the core of the HMIS is a personal electronic health record system that improves the tracking of disease outbreaks such as SARS and Bird Flu, the management of drug flows, and real-time monitoring of various diseases from HIV/AIDS to diabetes. However, unlike Australia, Belize remains plagued by infrastructure challenges, and thus does not yet have the horizontal preparedness to assure the scalability and sustainability of its strategy.

According to the WHO Global Health 2010 Progress Report, plans to complete ICT infrastructure rollout to support the eHealth strategy are still under way. Despite an upper-middle income status and a 76.9% adult literacy rate, Belize has an ICT diffusion index of only 30%, a mobile phone subscriber base of 35%, and an Internet penetration of 13.5%. With a per capita income of $6,866, the country’s funding base does not seem to be the primary challenge. Rather, the small size of the country and regulatory structures have limited competition and the ability to reap economies of scale in infrastructure deployment. Once the existing infrastructure challenges are addressed it will be easier for Belize to reduce ICT access prices to suit demand and provide the human resource training required to implement its ambitious national eHealth agenda.
Pillars of eHealth Strategy Development

Principles

Achieving a comprehensive integration of ICT into a country’s health system is a multi-faceted process involving the mobilization of resources across sectors and the coordination of stakeholders with different agendas. Despite the complexity of mainstreaming eHealth, there are several core principles that can be used to guide eHealth strategies and ensure that they support the overall goals of the health system. The best eHealth strategies focus and standardize their systems to be:

- **Personalized:** The system should be individualized for patients and providers, using individual patient status and treatment history in care decisions.
- **Ubiquitous:** All patients should have ready access to their health information, even when receiving care from providers or facilities.
- **Interoperable:** All providers and systems should be able to interact and exchange information with each other.
- **Interconnected:** All stakeholders and systems should be interconnected and, to the extent possible, able to leverage the same infrastructure.
- **Scalable:** Systems should be able to expand functionally, in terms of the workers that use them and the populations they serve.
- **Sustainable:** Services and systems should be affordable without operating at a loss and should ideally result in efficiency gains to the health system.
- **Secure:** Personal data should be secure from external and internal misappropriation.
- **Measurable:** Service access, quality and impact should be measurable.

Viable and comprehensive eHealth strategies aim to optimize existing processes—something that ICT, if properly implemented, can support. At the same time, it is important to note that simply overlaying ICT over flawed processes and systems will not accomplish health sector goals and may result in waste and a loss of confidence in the ability of ICT to improve the system. For this reason, eHealth strategies and tactics that are implemented as part of a larger reform of national health systems and processes may have a greater chance of succeeding than those that are introduced as a standalone program.
Pillars of eHealth Mainstreaming Strategies

The principles described above are critical to the formulation of eHealth strategies that can guide the introduction of systems that support healthcare development goals in an efficient and equitable manner. These principles can serve as a “checklist” that policy-makers consult as they design, approve, and implement systems. Yet the findings of this report also point to the existence of components that are equally important to successful eHealth initiatives. These “pillars” can reduce costs and redundancies, increase interactivity, and ensure measurable success across sectors. The pillars of eHealth (Figure 35) are:

- **Audit and Leverage National ICT Infrastructure:** eHealth interventions are dependent on the infrastructure. Encouraging eHealth interventions appropriate to a country’s existing infrastructure, then phasing interventions with the expansion of ICT infrastructure—particularly broadband Internet—can ensure that systems are designed with the operating environment in mind. As such, an audit of a country’s ICT assets (and deficiencies) is the first step toward giving leaders and implementers a clear picture of opportunities both present and future. Leveraging countrywide ICT infrastructure allows eHealth interventions that are appropriate to the country’s existing and planned ICT infrastructure and uses technology and media with which health workers and patients are familiar.

  *Challenges addressed:* Lack of health system infrastructure and communication between rural and urban centers

  *Examples:* The possibilities provided by Ethiopia’s WoredaNet, a national-scale eGovernment broadband network, and Australia’s 98% ICT penetration prove that it is as important to analyze ICT infrastructure as it is to assess population and health system needs.

- **Move toward Health Records and Personal Identification (ID):** Unique identifiers and records improve continuity of care, provide health system data and enable point-of-care decision support tools that empower patients and health workers. Development of record or identification systems is a complex undertaking that can involve political sensitivities, but such records are consistent with many of the principles described above. Such systems move the health system in a direction that gives greater power to patients while reducing inefficiencies, fraud, and waste. This is particularly true because individual records can fulfill a country’s HIS needs in a way that is more timely for policy-makers and more relevant to providers.

  *Challenges addressed:* Insufficient quantity of skilled health care workers, lack of health system infrastructure and communication between rural and urban centers.

  *Examples:* São Paulo and Belize HIS systems, and the OpenMRS system of medical records developed by the Regienstrief Institute and Partners in Health

- **Optimize HIS Processes:** Most national-level HISs involve cumbersome data recording and transmission processes that take time away from care provision and allow room for error. Digitizing patient records improves access to health data and facilitates the exchange of useful data between all
stakeholders—patient-to-patient, patient-to-provider, provider-to-provider, and providers-to-government. Reorganizing HIS processes, in conjunction with efforts to introduce electronic capture, storage, transmission and analysis of data, improves the quality of data used in resource allocation and enables faster or real-time action.

**Challenges addressed:** Equipment and supplies shortage, insufficient quantity of skilled health care workers and lack of health system infrastructure.

**Examples:** The Ethiopian HMIS and Indian National Rural Health Mission’s HMIS initiatives both involve the electronic capture and storage of health data. Each initiative began with a rationalization of the number and frequency of health indicators collected, as well as an optimization of the paper-based process before electronic capture was introduced.

- **Establish Guidelines for Developers:** Guidelines or “rules” are boundaries agreed by decision-makers to govern stakeholders’ use of health systems and the platforms on which they are managed. Rules allow developers, in particular, to create applications harmonized within a standardized eHealth architecture. Such guidelines should allow more developers to participate, increase competition and product options, and become a natural manager of e-service prices. They also relieve the government of the responsibility for creating all health applications, while ensuring interoperability between various systems.

  **Challenges addressed:** Lack of health system infrastructure and communication between rural and urban centers

- **Choose Appropriate Media:** It is important to use media (SMS, voice and video) or a combination of media that will reach and educate the largest number of people, especially given constraints such as illiteracy, multiple languages, and cultural differences. While advanced technologies often attract attention, simpler or more widely understood media may be more appropriate in many contexts, especially in low-resource settings. Where relevant, this would also apply to choosing the appropriate content and devices (mobile phones, notepads, notebooks, laptops, big screen televisions).

  **Challenges addressed:** Population uneducated about prevention and treatment of preventable diseases

  **Examples:** Text to Change in Cameroon, Project Masiluleke in South Africa, Text4Baby in the USA

The pillars of eHealth can work together within an eHealth ecosystem to resolve health sector-specific challenges when standards and principles are observed. Thus, the principles and pillars work hand-in-hand.
Key Dimensions for Mainstreaming eHealth

When developing strategy, policy-makers need to take into consideration the technological, financial, capacity and cultural dimensions of mainstreaming eHealth.

Technological Dimension

The technological dimension considers three layers of the eHealth ecosystem (administrative, collaborative and applications layers), as well as the stakeholders and content. Within each layer are hardware and software considerations.

- **Administrative Layer** – This is the layer that is managed by the primary decision-maker in the system. In the case of a national healthcare system, this is often the government or their designate. Within this layer are the national databases and records that are collected, secured and provided by the government to make the ecosystem successful.

- **Collaborative Layer** – This is the layer managed by the primary telecom network provider. In most cases, this is a telecom network provider owned or partially owned by the government that organizes other network providers to achieve the collaborative mandate. Within this layer are the rules that govern the ecosystem, technical items such as routers, Internet, frequency spectrum, towers, datacenters and other network infrastructure that will enable applications to function and be used, managed, replicated, monetized and shared.
- **Applications Layer** – This is the layer managed by the rules that exist within the collaborative layer. This layer is an “open” layer in which any developer, vendor or service provider can offer applications, services or products. Because it is “open,” it is governed by market principles that require applications, services and products to be relevant, available and reasonably priced. Because the Applications Layer is automated, government needs not intervene. Like the Internet itself, only the best applications, services and products will survive within this layer.

In the collaboration layer, it is important that national assets are made available to developers and that they are based on standards that encourage competition while enabling scale and sustainability.

*Figure 34: Technological dimension*
Financial Dimension

The financial dimension includes considerations that make it possible to base funding decisions on an accurate understanding of the total cost of ownership (TCO) of a particular technology or system. These considerations include airtime subsidization for health workers, devices, training, maintenance, operations expenses, capital expenses, and sustainability of the business model. Such financial considerations are best determined collaboratively, with representation from all stakeholder groups—patients, health workers, policy-makers, administrators, civil society, public donors and private financiers. Stakeholders must also agree to adhere to rigorous accounting standards.

Capacity Dimension

The capacity dimension includes infrastructure and human resource considerations. This includes telecommunication and Internet, as well as water and road infrastructure. The capacity dimension also includes data, human, technical (support) and administrative capacity. Planning for both short- and long-term capacity building is important, particularly if external resources are needed.

Cultural Dimension

The cultural dimension includes sociological considerations that may reflect the unique characteristics of each nation and its people. These considerations include culture, traditions, beliefs, practices, norms and taboos. More specifically, the considerations include illness models, privacy concerns, language, spending habits, diversity, gender roles and religion. These considerations are especially important given the vast cultural diversity in most African nations.

Cultural considerations also factor into how an ICT intervention will change the ways health workers perform tasks. There is often resistance to changes in the way workers do their jobs. With ICT interventions, health workers might fear that they will not be able to effectively use the technology or that it might displace them, or that it will add to their workload rather than reducing it. For these reasons, it is critical to have effective training and change management programs in place to ensure that health worker support the initiative. Inability to obtain this support may indicate that health workers doubt the relevance or need for the system.

The above dimensions need to be considered as part of a 360-degree matrix to form a more complete picture of the situation and needs of the nation. With this information, it becomes possible to formulate analyses that will more responsibly inform the strategies to build an eHealth system that meets a country’s health needs.
Conclusions, Lessons and Implications

ICT-based interventions, across all sectors, sometimes fail. Typically, they do so because they do not match the needs and requirements of the stakeholders involved (or their ability to do so has not been adequately communicated), they cannot be supported by the technical, physical, and human infrastructure in which they are based, or because the underlying systems on which they are being overlaid are faulty. The principles, pillars and dimensions described in this chapter are meant to highlight some of the key considerations that can be taken into account by policy-makers and donors as they attempt to mainstream eHealth in African contexts.

One of the striking findings is the number of considerations that are not technology-related. The nature of conversations about eHealth is often dominated by technology considerations, but non-technology factors are often at the heart of intervention failures. Resistance to change, a failure to consider user need, inadequate consideration of the environment required to support ICT-based changes, and faulty underlying systems can all contribute to the failure of projects with impressive technology at their core.

ICT-based interventions in health are often presented as disruptive or radical changes to existing ways of providing health services. Mainstreaming eHealth, making ICT a fundamental part of delivering care and managing health systems, requires adherence to principles, an understanding of the dimensions involved in introducing ICT, and a recognition of the central pillars that support a comprehensive eHealth strategy. By observing the principles and pillars of eHealth strategy development and the dimensions of eHealth mainstreaming, policy-makers, administrators and project designers can overcome many of the macro and micro challenges discussed in Chapters 3 and 4 and move toward a health system in which technology is an enabler of better outcomes.
Chapter 6: Recommendations to Policy-makers and Regulators

The previous chapter explored some of the fundamental elements in any successful strategy for mainstreaming eHealth at a national level. Chapters 6 and 7 look at the practical steps that national policy-makers, regulators and international donors can take in order to ensure that these elements are present as African nations move toward using ICT to transform their health sectors. The recommendations in this chapter will be most relevant to those who participate in and influence the delivery of ICT health solutions within African countries and across Africa. The recommendations will help policy-makers and regulators to:

- Design strategies with appropriate and sustainable ICT environments for health sector interventions
- Implement interventions that produce desirable and measurable results
- Evaluate the impact of these interventions
- Develop fast-track options for multi-country collaborations

**Recommendation #1: Create Scalable Architecture Governed by Rules**

**Create a Scalable Architecture**

When an architect designs a house, she should do so with the thought that the building might be expanded over time. An eHealth system should be designed according to the same principle. A scalable architecture should be established to assure the system can expand to meet new capacity requirements, adapt to social or political changes, and continue to function despite financial limitations. This eHealth ecosystem architecture should accommodate changes amongst stakeholders, content and the interaction between consumers, administrators, application developers, vendors, policy-makers, regulators, civil society and funders. ICT makes it easier to establish, automate, manage, and modify the variables that enable scalability in a dynamic environment.

**Establish Rules Based on Principles**

Every system needs order, and rules allow stakeholders to develop and implement ordered eHealth implementations. Rules provide boundaries that govern stakeholders’ use of health systems and the platforms on which they are managed. They allow developers, in particular, to create applications for a standardized eHealth architecture. However, if the rules are too rigid, then the system may discourage innovation. It may not attract enough players to create options and generate competition that provides consumers the best service at the optimum price. This is why it is important to base the rules on general principles agreed to by representatives of the key stakeholder groups.

As long as the principles are observed, the rules will likely help the project to achieve the desired objectives. As Figure 36 illustrates, rules and principles rest in the collaborative layer of the eHealth ecosystem architecture. Stakeholders will have access to this layer, which will enable them to plug in applications and redeem services. Principles and rules also govern the levels of privilege and authorization for each stakeholder group or individual. The existence of agreed-upon rules also encourages application developers to consider how their application or program will interact with other parts of the eHealth ecosystem and develop long-term plans for scaling. Policy-makers can encourage compliance by developing “checklists” that clearly state the rules and require a plan for scaling and sustaining the intervention.
The security of the eHealth system is also an important consideration when developing rules for a scalable architecture. Whereas licensed medical practitioners are usually bound by an oath of confidentiality, non-medical handlers of sensitive data are not. This may allow patient data to be mishandled, misused and abused. To improve data security, Salvi et al suggest that non-medical handlers of sensitive data be held to the same level of accountability as licensed medical practitioners. This is a critical issue, and the place to establish such a requirement is within the system’s rules.

**Recommendation #2: Combine Needs Assessment, Situation Analysis and Infrastructure Assets Assessment to Map Interventions**

**Perform a Needs Assessment and Situation Analysis**

Before large-scale investments in eHealth are undertaken, policy-makers should commission a comprehensive needs assessment and situation analysis. The needs assessment will provide an up-to-date, objective view of the health and intervention needs of the population and of health workers. The situation analysis provides an examination of the state of the health system within the context of the society, and of the resources available to support ICT-based interventions, including physical infrastructure, human capacity, and telecommunications networks.

With the support of the Bill & Melinda Gates Foundation, the Ethiopian Ministry of Health commissioned a needs assessment and situation analysis for their maternal and newborn child health programs. They did this because, according to a director in the Ministry, “There are so many projects floating around that it is difficult to know what project is meant to resolve what challenge. We decided to streamline, better understand our population and the national situation that is contributing to their difficulties or has the possibility of helping to alleviate their pains.” The result of their inquiry was a report that provides them a phased framework for appropriating ICT interventions—particularly mobile interventions—that will first empower health extension workers, then the community, then the country.

**Conduct an Infrastructure Asset Assessment**

It is equally important to perform an infrastructure asset assessment, because eHealth strategies and interventions should leverage existing and available infrastructure wherever possible. Because of a lack of communication within and between government ministries and agencies, many policy-makers are not aware of their country’s existing assets and how those might be used to achieve their eHealth vision.

Questions asked during such an assessment touch on the assets that exist across sectors. How numerous are the hospital beds and ICT devices? How about the broadband Internet infrastructure assets? Road networks? Water works? Who owns the access rights? Who regulates it? Which portions of this infrastructure are available for public services? Which portions are private? Which regulator or governmental department has leverage over its owners? Is there possibility for a public-private partnership? Can a cross-sector alliance be formed with another ministry, agency, state, or municipality? How many telecom operators are there in the country? What is the coverage of these networks? What technologies do they use?

These are just a few of the questions that informed policy-makers must ask and be able to answer about their country’s existing infrastructure in order to design strategies that do not overlook, duplicate, and waste those assets.
Performing such an exercise will also allow the policy-makers to determine the gap between existing infrastructure assets and those necessary to fulfill their vision. A thorough assessment of infrastructure assets will also identify sources of funds, including from donors, that might be able to help fill this gap.

During the 2004-2005 tsunami, triggered by an earthquake that impacted five Asian nations, Thailand found useful the extensive infrastructure and capacity it had already built to provide its 65 million residents with 90% of their healthcare needs. The rapid response organized by the Ministry of Public Health (MOPH), Center for Disease Control (CDC), WHO and other major organizations, was made possible by Thailand’s knowledge of both its healthcare and communications infrastructure, including 10 hospitals, 2,000 beds, laboratories, local and non-local healthcare professionals. With the data collected using the WHO rapid assessment tool, the Thai were able to treat over 90,000 affected people within 15 days.

**Map Interventions**

Subsequently, policy-makers should map appropriate interventions based on the combination of needs, situation and infrastructure status of their country. For example, a country with a robust community health worker program to support the needs of pregnant mothers, surrounded by extensive broadband infrastructure and a poor road network, might design SMS, voice, or video interventions. The same country might then plan a phased introduction of other interventions that would be enabled by future developments (e.g., improved roads, a spike in mobile subscriptions, the introduction of mobile-based financial services).

**Recommendation #3: Create Forums to Bring Decision-makers Together**

Facilitation of cross-sector dialogue and cooperation is one of the key roles that national governments can play. Creating forums or working groups in which both public- and private-sector decision-makers can collaborate with one another to determine priorities and identify available assets can reduce fragmentation and accelerate time to scale. A well-executed forum will create opportunities for those groups, with a common frame of reference, to work with their counterparts in other countries. It allows diverse stakeholders to share best practices and capitalize on economies of scale through regional collaborations. A possible avenue to promote such collaboration is through the Regional Economic Communities. Such forums could be facilitated by the African Union and World Bank, on the public side, and the International Finance Corporation (IFC) and African Development Bank on the private side.

**Recommendation #4: Create Incentives for Partnerships and Cross-Sector Collaboration**

The multi-faceted nature of eHealth requires that the skills and resources of multiple sectors are needed to successfully introduce and scale projects. National policy-makers can facilitate multi-sector partnerships that include not only government and the private sector, but also universities and other research and development organizations. Public-private partnerships can yield projects and organizations that combine corporate fiscal discipline and deep understanding of consumer needs. Policy-makers can incentivize participation in such partnerships by giving private companies preferred vendor status in return for active participation. Regulators may require that public entities solicit cooperation from NGOs and private-sector organizations.

When empowered, researchers, scholars and innovators can also produce new ideas, products and services whose implementation might create new life-cycles for existing products and services, or for society as a whole.
The research-driven pharmaceutical and bio-technology industries of Boston, Silicon Valley and Singapore are just a few examples. The opportunity exists for such research and development, innovation and job creation to originate in each African country and region based on local needs, situation and resources. This is especially the case for opportunities that include healthcare professionals and investors from the diaspora. This is a great opportunity to turn the health sector “brain drain” discussed in Chapter 2 to “brain gain.”

**Recommendation #5: Phase Interventions to Institutionalize the Use of ICT and Maximize Impact**

Policy-makers and administrators should use a multi-phased approach to target specific segments of the healthcare community. Administrators should consider the needs, situation and infrastructure of the country to optimize intervention and cost.

For Ethiopia, for example, Vital Wave Consulting recommended a phasing of mHealth interventions that would begin with health extension workers, who show a 90% ownership of mobile phones, in contrast to the 8% penetration in the general population. Subsequent phases took into consideration the cost and simplicity of the intervention as infrastructure expanded to meet the needs and situation of more complex populations.

Policy-makers and administrators should at first aim for simple, low-cost interventions such as calling networks that institutionalize the use of ICT for health workers before attempting more complex system-based interventions that interact with other health technology initiatives. The more ICT is a part of the healthcare worker’s daily engagement, the more likely eHealth interventions will become accepted as norm.

**Recommendation #6: Encourage Development of Platforms with Cross-sector Potential**

Development of ICT-based solutions tends to be “silied,” or done within a vertical sector and not applicable to other sectors or uses. Yet creating a cross-sector digital platform with potential use across health, financial services, agriculture, public services, and education could accelerate the scaling and sustainability of ICT-based interventions by increasing economies of scale and return on investment. This is particularly important in African countries that are small markets, where sector-specific platforms may not be viable given their relatively small user or customer base. In some countries, mobile platforms that offer services in other sectors, such as mobile money transfer, may provide a base on which health services can be added.

Creating cross-sector platforms requires cooperation of many stakeholders across sectors, but this can be a natural extension of the asset and infrastructure assessment described in Recommendation #2. Creating such platforms can also reduce redundancies and increase efficiencies across a range of categories, including device costs, back-end systems and technical and human capacity.

**Recommendation #7: Lay the Groundwork for National ID Systems**

In Chapter 5, health records linked to individuals are identified as a key pillar of successful eHealth strategies, because of their potential to improve continuity of care, enable point-of-service devices, and feed nation-wide health information systems. As many African countries move toward programs designed to provide universal access to basic health care, the creation of unique identifiers that can form the basis of individual, digitized health records is a strong first step. Countries like Ghana, which has moved toward a national health insurance
program, are assigning insurance numbers to citizens that could eventually be linked to digital health records. Similarly, Ethiopia’s “family folders” program is an effort to develop patient records that could eventually be converted into digital format. Even for countries that do not yet have the resources to develop or deploy national electronic record systems, a well-organized paper-based system of identification is a step in the right direction.

Unique identifiers have applications in other sectors as well. Lack of identification is a major obstacle to increasing access to financial services and a key reason for the level of fraud and waste in public services. The massive identification program underway in India will serve as perhaps the largest and most prominent laboratory for the number and breadth of services that will be enabled when an entire country’s population participates in a biometric identification scheme.

Recommendation #8: Require and Incentivize Impact Measurement

Despite the extensive anecdotal evidence associated with the power of ICT to improve health system functioning and outcomes, the lack of measurable, longitudinal data is one of the biggest barriers to eHealth investment. In order to justify the investment in these interventions, governments should take a more active role in either conducting rigorous impact studies through robust monitoring and evaluation programs, or creating incentives for universities or NGOs to play this role. Incentives could include allowing such institutions to use the data they assist in collecting and analyzing (with protections in place for ensuring the privacy and confidentiality of individual patients), or the use of government-owned facilities and infrastructure.

Recommendation #9: Conduct a Total Cost of Ownership (TCO) Analysis

The dimensions of eHealth interventions described in Chapter 5 underscore the number of considerations policy-makers and regulators must keep in mind as they move forward. A common reason for the inability of eHealth interventions to scale or sustain themselves is the failure by planners to consider all of the financial costs associated with such programs. Often, technology (and especially hardware) costs comprise the entire budget, with inadequate attention to training, support, maintenance, and operating costs. Conducting a rigorous total cost of ownership (TCO) study can prevent unforeseen costs from damaging projects’ chances for success. Performing a TCO study can also force planners and partners to consider all of the elements they will need to plan for and how each of them will be funded.
Chapter 7: Recommendations to the Donor Community

National policy-makers in African countries obviously maintain the central role in setting a course for eHealth development in their societies. Many of these countries, however, remain heavily dependent on donor funds and expertise. Thus, donors have a critical role to play in encouraging policies and practices that move countries toward sustainable and scalable eHealth. The following recommendations will be most relevant to those who fund projects and developments within the health sector in African countries and across Africa. The recommendations will help donors and other health sector investors to:

- Design a course of action to include ICT in policy and planning discussions with country counterparts when considering developmental investments.
- Designate a role for the public and private sectors, bearing in mind that government is increasingly positioned as a lead user and regulator of ICTs while the private sector is increasingly positioned as a lead provider—even in cases of public-private partnerships.

Recommendation #1: Incentivize Policy-makers to Create and Use eHealth Architecture Based on Rules

Incentivizing recipient governments to create eHealth ecosystems that are governed by rules within a scalable and sustainable framework should be a top priority for donors. Donors should first encourage countries to adopt policies that are driven by architectures and frameworks that enable developers and vendors to provide the best services and applications at the most affordable prices. The same architecture should enable government to regulate the sector without obstructing activities or services provided by public- and private-sector service providers.

Donors can, for example, create or add to project checklists the desired systems characteristics (e.g., interoperable, scalable, sustainable, multi-layered, and supported by a private-public partnership) that would have to be present before donors fund countries or projects. Those countries that fulfill the conditions listed on the checklists would enjoy a fast-track status on applications. So long as donors receive the buy-in of policy-makers and administrators, such a system would help establish inter-country standards that could only benefit the African continent overall. As such, donors could use the same ICT solutions and programs to help all countries establish standards of excellence for eHealth deployment.

Recommendation #2: Establish and Use a Cross-Agency Resource Platform for Donors

Donors should use ICT to establish standards among themselves—regarding nomenclature, metrics and databases. They can use ICT to automatically cross-reference one another’s research, pre-empt disagreements, and promote collaboration. Donors’ use of ICT in this way could reduce costs, minimize duplication and increase the benefit of each of their efforts.

Donors can integrate such resources as the WHO eHealth Atlas to develop and agree upon needs assessments and situation analyses for individual countries and regions. They can agree on databases containing comparative information about ICT, road and health system infrastructure, as well as more nuanced data about culture and
communication patterns. These bodies of information, once blessed by a cross-agency agreement, could make it easier to calculate potential interventions that would also enjoy cross-agency support. Common sources of data would also make it possible for donors to create groupings of countries with similar needs and situations that call for similar ICT resources to deploy possible interventions.

**Recommendation #3: Encourage Dialogue, Partnerships and Collaboration between Healthcare Decision-makers**

In areas where African countries participate in regional forums and cooperation efforts, economies of scale could be derived from collaborations. To share best practices and encourage collaborations within and between countries, donors should create physical and virtual forums between ICT and health decision-makers.

For example, the success of UNICEF’s rollout of RapidSMS to improve supply chain management during the famine in Ethiopia could be replicated in similar situations in other countries, such as Somalia. The Horn of Africa countries—Ethiopia, Somalia Djibouti, Erertria and Kenya—could collaborate to establish emergency interventions in case of famine. But such dialogue needs encouragement to lead to partnerships and collaboration.

**Recommendation #4: Archive Impact Assessments for All Projects**

Donors should archive and make available impact assessments for all projects, and reward those that provide useful assessments. They can do so by providing follow-up funding to countries and projects that record the impact of eHealth interventions with standardized ROI analyses. Such standardization should encourage policy-makers, administrators and project designers to actively and consciously integrate measurement and evaluation into their eHealth strategies.

Donors should also archive the impact assessments that are collected from myriad projects for in-country and cross-country comparison. The comparative data, resulting case studies and subsequent exchanges between agencies, organizations and countries will help the larger health community make better short- and long-term decisions about eHealth strategies and the interventions that could justify them.

**Recommendation #5: Reward Cross-sector and PPP Efforts in eHealth Systems Development**

Donors should encourage and reward countries that demonstrate a commitment to maximizing ICT for cross-sector and public-private partnership (PPP) and collaborations. Such a position among donors will encourage meaningful dialogue, interaction and collaboration between such agencies and ministries as health, technology and education, which are mostly cost centers, with such ministries as communication and finance, which are revenue centers. In fact, donors should make cooperation within government, and involvement of other relevant sectors, a pre-requisite for financial or technical assistance.

For example, donors could encourage the development of a strong private sector by requiring an increased role of indigenous private technology companies in the development of eHealth interventions sponsored or deployed by the public or NGO sector. Possible cross-sector and public-private collaboration can be assessed through the cross-agency knowledgebase established among donors, policy-makers and administrators.
Also, donors could encourage eHealth stakeholders to focus their energy and resources on improving technologies that are already being used. JavaROSA, a product of the OpenROSA Consortium, is an example of such an application. JavaROSA is an open source solution that can be modified by developers to collect, analyze and manage data. It is used in places as distant as Kenya, Pakistan, South Africa, Tanzania, Uganda, Bangladesh, Mexico and Zambia. It is used for such applications as survey data collection, disease surveillance, healthcare worker training and guidance, and longitudinal medical record collection and management. JavaROSA’s flexible architecture makes it possible for developers to create new applications without adding much more code. The best attributes of such versatile solutions should be studied, encouraged and replicated. The effort should be both public and private.

**Recommendation #6: Seek Alignment between Donors and Encourage Donor-Agnostic ICT Interventions**

ICT systems that are built to support an individual donor’s programs, especially in disease-specific projects, is often cited as a major reason for the fragmentation of the eHealth landscape. Understandably, ICT systems are designed to fit the parameters of specific programs, but this frequently has the effect of producing systems that are not interoperable with other health technology systems, thus reducing the possibility of long-term scale. Donors can do their part to improve this situation by coordinating their technology funding initiatives and seeking alignment with each other on common standards, as well as by adhering to the “rules” established by national governments (and discussed in the previous chapter).

Improving coordination in this area does not mean that donors and funders cannot pursue innovative new technologies, but it does mean that this should be done with an eye to eventual integration or cooperation with the larger eHealth ecosystem in all African countries. Coordination along these lines could also reduce the possibility of duplicated efforts and increase longer-term economies of scale for donors looking to maximize return on their investments.
Appendix A: Comparative Country Profiles

This appendix compares seven countries along five MDG-related dimensions. The list of countries is comprised of 2 case-focus African countries (Ethiopia and Mali), 4 other African countries (Angola, Botswana, Tunisia and Gabon), and 1 non-African country (Thailand). The comparative dimensions are: 1) life expectancy at birth, 2) mortality rate (under-five), 3) prevalence of HIV, 4) GDP per capita (USD), and 5) mobile cellular subscribers (per 100 persons). Unsurprisingly, health indicators improve as income and ICT prevalence increase.

Figure 36: Life Expectancy (Years)

Figure 37: Under-Five Mortality (per 1,000)
Figure 38: HIV Prevalence (ages 15-49)

- Angola
- Botswana
- Ethiopia
- Equitorial Guinea
- Gabon
- Mali
- Thailand
- Tunisia

Figure 39: GDP per Capita (USD)

- Angola
- Botswana
- Ethiopia
- Equitorial Guinea
- Gabon
- Mali
- Thailand
- Tunisia

Figure 40: Mobile Cellular Subscriptions (per 100 persons)

- Angola
- Botswana
- Ethiopia
- Equitorial Guinea
- Gabon
- Mali
- Thailand
- Tunisia
## Projects

<table>
<thead>
<tr>
<th>Application Name</th>
<th>Company</th>
<th>Purpose</th>
<th>Type of Application</th>
<th>Location Implemented</th>
<th>Type of Phone</th>
<th>Link</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teledermatology</td>
<td>Orange</td>
<td>Distance diagnosis of dermatological problems</td>
<td>MMS</td>
<td>Egypt</td>
<td>Feature</td>
<td><a href="http://www.thri.org/?page=detail-contributions&amp;id=688&amp;provenance_context_id=13">http://www.thri.org/?page=detail-contributions&amp;id=688&amp;provenance_context_id=13</a> &amp;provenance=88</td>
<td>Health workers take a picture of a dermatological problem and record basic patient info, send it to a doctor who diagnose and sends back a treatment plan</td>
</tr>
<tr>
<td>Rapid SMS</td>
<td>UNICEF Ethiopia</td>
<td>In October 2008, Ethiopia experienced crippling droughts. Faced with the possibility of famine, UNICEF Ethiopia launched a massive food distribution program to supply the high-protein food Plumpy'nut to under-nourished children at more than 1,800 feeding centres in the country.</td>
<td>SMS</td>
<td>Ethiopia</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/case-studies/supply-chain-management-during-food-crises/">http://www.rapidsms.org/case-studies/supply-chain-management-during-food-crises/</a></td>
<td></td>
</tr>
<tr>
<td>SmartCare</td>
<td>Zambian Min of Health, Center for Disease Control, Elizabeth Glaser Pediatric AIDS Foundation, Center for Infectious Disease Research in Zambia (CIDRZ), Tulane University Technical Assistance Project Ethiopia (TUTAPE)</td>
<td>SmartCare supports longitudinal record-keeping for a variety of health verticals, including HIV/AIDS treatment, TB care, VCT, and antenatal care. It provides clinical decision support, touchscreen interaction, off-line data synchronization, and data portability via the use of smart cards. Additionally, the system provides complex data access through a large catalog of reports that includes HMS reports, PEPFAR reports, early warning indicators, clinical decision support, and individual patient summaries.</td>
<td>SMS, Database</td>
<td>Ethiopia, Zambia</td>
<td>Basic</td>
<td><a href="http://www.dimagi.com/smartcare/">http://www.dimagi.com/smartcare/</a></td>
<td></td>
</tr>
<tr>
<td>ClickDiagnostics</td>
<td>Multiple mHealth and tele-medicine products</td>
<td></td>
<td>SMS</td>
<td>Ghana, Egypt, Botswana, Bangladesh</td>
<td></td>
<td><a href="http://clickdiagnostics.com/services/mhealth-services-offering/">http://clickdiagnostics.com/services/mhealth-services-offering/</a></td>
<td></td>
</tr>
<tr>
<td>Open Data Kit</td>
<td>University of Washington</td>
<td>Open Data Kit (ODK) is a free and open-source set tools which help organizations author, field, and manage mobile data collection solutions. ODK provides an out-of-the-box solution for users to: - Build a data collection form or survey; - Collect the data on a mobile device and send it to a server; and - Aggregate the collected data on a server and extract it in useful formats. In addition to socio-economic and health surveys with GPS locations and images, ODK is being used to create decision support for clinicians and for building multimedia-rich nature mapping tools.</td>
<td></td>
<td>Ghana, Kenya, Mozambique, Nigeria, South Africa, Tanzania, Uganda</td>
<td></td>
<td><a href="http://code.google.com/p/opendatakit/">http://code.google.com/p/opendatakit/</a></td>
<td><a href="http://opendatakit.org/about/deployments">http://opendatakit.org/about/deployments</a></td>
</tr>
<tr>
<td>CAM DPS, CAM RANDI</td>
<td>Supply Chain Management for rural Coffee Coops</td>
<td></td>
<td>SMS</td>
<td>Guatemala</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChildCount</td>
<td>the Earth Institute in collaboration with the UNICEF Innovation Group for the Millennium Villages Project</td>
<td>uses SMS text messages to facilitate and coordinate the activities of field based health care providers, usually community health care workers (CHWAs). Using simple text messages, CHWAs are able to register patients and send in health reports to a central web dashboard that allows a health team to closely monitor the health of their community. Powerful messaging features help facilitate communication between the members of the health system and an automated alert system helps reduce gaps in treatment.</td>
<td>SMS</td>
<td>In Millennium Villages</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/overview/projects/childcount/">http://www.rapidsms.org/overview/projects/childcount/</a></td>
<td><a href="http://www.childcount.org/">http://www.childcount.org/</a></td>
</tr>
<tr>
<td>12</td>
<td>ART Project (Telkom)</td>
<td>Telkom Kenya</td>
<td>Place order and monitor supply chain of ART medicine</td>
<td>SMS</td>
<td>Kenya</td>
<td>Feature</td>
<td><a href="http://www.ifri.org/?page=detail-contribution&amp;id=6081&amp;id_provenance=88&amp;provenance_context_id=13">http://www.ifri.org/?page=detail-contribution&amp;id=6081&amp;id_provenance=88&amp;provenance_context_id=13</a></td>
</tr>
<tr>
<td>13</td>
<td>Map of Medicine for Kijabe Hospital</td>
<td>UNKHS, Cisco’s IBSG</td>
<td>Remote Data Collection - gives rural health workers access to a medical information database</td>
<td>Web-based</td>
<td>Kenya</td>
<td>PDA</td>
<td><a href="http://www.vitalwaveconsulting.com/pdf/milehealth.pdf">http://www.vitalwaveconsulting.com/pdf/milehealth.pdf</a></td>
</tr>
<tr>
<td>14</td>
<td>Rapid SMS</td>
<td>Millennium Villages/UNICEF</td>
<td>A recent Million Villages Project, with support from UNICEF, is customizing RapidSMS to address under five mortality rates at a community level. This initiative brings diagnoses, referrals and treatment out of the clinics and into the communities.</td>
<td>SMS</td>
<td>Kenya, Pakistan, South Africa, Tanzania, Uganda, Bangladesh, Mexico, and Zambia</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/case-studies/">http://www.rapidsms.org/case-studies/</a></td>
</tr>
<tr>
<td>15</td>
<td>JavaROSA</td>
<td>Dimagi</td>
<td>JavaRosa is an open-source platform for data collection on mobile devices. At its core, JavaRosa is based on the XForms standard – the official W3C standard for next-generation data collection and interchange. JavaRosa is written in Java Mobile Edition (J2ME), and supports a wide array of devices, from top-end smart phones and PDAs with large screens and abundant memory, to low-end devices like the Nokia 6085 and 2630. Making JavaRosa usable on low-resource devices is one of the project’s highest priorities.</td>
<td>Platform</td>
<td><a href="http://code.jarovasa.org/">http://code.jarovasa.org/</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Rapid SMS</td>
<td>UNICEF Malawi</td>
<td>UNICEF Malawi deployed RapidSMS to address serious constraints within the national Integrated Nutrition and Food Security Surveillance System, which was facing slow data transmission and incomplete and poor quality data sets. Automated basic diagnostic tests, are now identifying more children with moderate malnutrition who were previously falling through the cracks.</td>
<td>SMS</td>
<td>Malawi</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/case-studies/malawi-nutritional-surveillance/">http://www.rapidsms.org/case-studies/malawi-nutritional-surveillance/</a></td>
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<tr>
<td>17</td>
<td>Ikon</td>
<td>Société Malienne d’Imagerie Médicale, IICD</td>
<td>Transmit radiological images to hospital with radiologist for diagnosis</td>
<td>MMG</td>
<td>Mali</td>
<td>Feature</td>
<td><a href="http://www.iicd.org/projects/mali-teleradiology">http://www.iicd.org/projects/mali-teleradiology</a></td>
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<tr>
<td>19</td>
<td>Pesinet</td>
<td>Pesinet</td>
<td>Data collected weekly, sent to a database where abnormalities are flagged and addressed by local health workers</td>
<td>Java Form-based SMS</td>
<td>Mali, Senegal, Niger</td>
<td>Feature</td>
<td><a href="http://www.pesinet.org/wp/2009/09/service/">http://www.pesinet.org/wp/2009/09/service/</a></td>
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<td>20</td>
<td>Mozambique Health Information Network (MHIN)</td>
<td>IDRC, AED SATELIFE</td>
<td>Health information dissemination, data collection and reporting, and email exchange</td>
<td>SMS</td>
<td>Mozambique</td>
<td>PDA</td>
<td><a href="http://www.mhealthinfo.org/project/mozambique-health-information-network-mhin">http://www.mhealthinfo.org/project/mozambique-health-information-network-mhin</a></td>
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<tr>
<td>21</td>
<td>Herero Database</td>
<td>Ovahero Traditional Authority</td>
<td>Record Keeping, Monitor Agricultural Movements</td>
<td>SMS?</td>
<td>Namibia</td>
<td>Basic</td>
<td><a href="http://www.balancingact-africa.com/news/en/issue-no-84/#/relevance/ovahero-en/">http://www.balancingact-africa.com/news/en/issue-no-84/#/relevance/ovahero-en/</a></td>
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<tr>
<td>22</td>
<td>Rapid SMS</td>
<td>Rapid SMS</td>
<td>In Nigeria, RapidSMS was piloted in the first phase of a 70 million ‘long lasting insecticide-treated nets’ distribution campaign. As a pilot activity, RapidSMS was used in Kano state to capture data of commodities from state stores to the Local Government Area and distribution points.</td>
<td>SMS</td>
<td>Nigeria</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/case-studies/nigeria-monitoring-supplies-in-a-campaign-setting/">http://www.rapidsms.org/case-studies/nigeria-monitoring-supplies-in-a-campaign-setting/</a></td>
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<tr>
<td>23</td>
<td>Learning About Living</td>
<td>OneWorld, ActionAid, EVA, Butterfly Works, MTN Foundation, Ministry of Health Norway School of Telemedicine</td>
<td>Education and awareness - eTeaching tool to teach young people about HIV/AIDS, sex and healthy relationships</td>
<td>SMS, hotline or online</td>
<td>Nigeria</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/case-studies/nigeria-monitoring-supplies-in-a-campaign-setting/">http://www.rapidsms.org/case-studies/nigeria-monitoring-supplies-in-a-campaign-setting/</a></td>
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<tr>
<td>24</td>
<td>Mobile Video in Emergency Situations</td>
<td>Mobile Video in Emergency Situations</td>
<td>Give real time visual instructions to lay people attempting to save someone in an emergency situation</td>
<td>Mobile Video</td>
<td>Norway</td>
<td>Smart</td>
<td><a href="http://mobihealthnews.com/10690/study-mobile-video-can-boost-first-aid-situations/">http://mobihealthnews.com/10690/study-mobile-video-can-boost-first-aid-situations/</a></td>
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<tr>
<td>25</td>
<td>SMSAll</td>
<td>Omar Saif</td>
<td>SMS messages to a group (Twitter for SMS)</td>
<td>SMS</td>
<td>Pakistan</td>
<td>Basic</td>
<td><a href="http://www.mobileactive.org/sms/growth-sms-mailing-list-pakistan-1">http://www.mobileactive.org/sms/growth-sms-mailing-list-pakistan-1</a></td>
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<tr>
<td>26</td>
<td>TRACNet</td>
<td>Rwandan Ministry of Health, Voixia, and the Treatment Research and AIDS Centre (TRAC)</td>
<td>an electronic records system that can be uploaded to mobile phones; includes an toll-free number to call in the records as well; allows practitioners to track ARVs in real time</td>
<td>Platform</td>
<td>Rwanda</td>
<td></td>
<td><a href="http://www.vn.org/esa/ssp0607/publications/africa_cases/ttaccine4.pdf">http://www.vn.org/esa/ssp0607/publications/africa_cases/ttaccine4.pdf</a></td>
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<tr>
<td>28</td>
<td>Rapid SMS</td>
<td>Rapid SMS</td>
<td>In Somalia, a RapidSMS project for emergency response monitoring is currently in the testing phase, leading to deployment in southern Somalia. Prior to the involvement of</td>
<td>SMS</td>
<td>Somalia</td>
<td>Basic</td>
<td><a href="http://www.rapidsms.org/case-studies/">http://www.rapidsms.org/case-studies/</a></td>
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<tr>
<td>#</td>
<td>Project Name</td>
<td>Description</td>
<td>Location</td>
<td>Website</td>
<td></td>
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<td>29</td>
<td>Cell-Life</td>
<td>Works with 50 organizations in South Africa and uses mobile technology to battle HIV</td>
<td>South Africa</td>
<td><a href="http://www.cell-life.org/home">http://www.cell-life.org/home</a></td>
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<td>30</td>
<td>Netcare 082 911</td>
<td>Hotline where medical professionals can give advice on non-urgent cases and give directions on emergency care and directions to appropriate centers</td>
<td>Voice</td>
<td><a href="http://www.arrivealive.co.za/Print.aspx?c=561-2274">http://www.arrivealive.co.za/Print.aspx?c=561-2274</a></td>
<td></td>
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<tr>
<td>31</td>
<td>Project Masiluleke</td>
<td>SMS information about HIV and testing centers, advertise helpline</td>
<td>SMS</td>
<td><a href="http://www.mahato.com/project-masiluleke/">http://www.mahato.com/project-masiluleke/</a></td>
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<tr>
<td>35</td>
<td>ICT4Health</td>
<td>Post Articles, Blog, Discuss ICT Health in country</td>
<td>Website</td>
<td><a href="http://afyaamandao.networking.ning.com/ict4health">http://afyaamandao.networking.ning.com/ict4health</a></td>
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<td>36</td>
<td>E-IMCI</td>
<td>A program that runs on a mobile device and guides a health worker step-by-step through the IMCI treatment algorithm. The current system covers only first visits for children 2 months to five years old, and does not cover immunizations or malnutrition.</td>
<td>Tanzania</td>
<td><a href="http://www.dimagi.com/mobile-e-imci/">http://www.dimagi.com/mobile-e-imci/</a></td>
<td></td>
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<td>37</td>
<td>CommCare</td>
<td>A CHW will have a phone running the CommCare software to assist them in managing household visits. CommCare will collect and report data that will help monitor and evaluate community health programs themselves.</td>
<td>SMS</td>
<td><a href="http://www.mohandenz.com/Papers/art1004-0derenzi.pdf">http://www.mohandenz.com/Papers/art1004-0derenzi.pdf</a></td>
<td></td>
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<td>38</td>
<td>Clinic Directory and Health Tips (Powered by Google SMS)</td>
<td>Provides users with timely, trusted, accurate, and actionable information on sexual and reproductive health.</td>
<td>SMS</td>
<td><a href="http://www.grameenfoundation.applab.org/section/health-appro.png">http://www.grameenfoundation.applab.org/section/health-appro.png</a></td>
<td></td>
<td></td>
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<tr>
<td>39</td>
<td>GATHER</td>
<td>The GATHER consortium is a standards-based architecture designed to facilitate data collection and reporting, with pluggable and interchangeable components/modules for data entry from a full range of wired and mobile computing devices and technologies, including desktops, laptops, telephones, personal digital assistants (PDAs), text messaging with cell phones, interactive voice recognition (IVR), geographical positioning systems, and bar-code scanners.</td>
<td>Uganda</td>
<td><a href="http://www.healthnet.org/gather">http://www.healthnet.org/gather</a></td>
<td></td>
<td></td>
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<tr>
<td>42</td>
<td>eMOCHA</td>
<td>Data Collection, Education</td>
<td>Form Based, SMS</td>
<td><a href="http://www.mobilityactive.org/emoca-form-based-mobile">http://www.mobilityactive.org/emoca-form-based-mobile</a></td>
<td></td>
<td></td>
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<tr>
<td>43</td>
<td>EpilHandy</td>
<td>Remote Data Collection - collect and record data by PDA or mobile phone</td>
<td>SMS</td>
<td><a href="http://www.vitalwaveconsulting.com/pdf/mHealth.pdf">http://www.vitalwaveconsulting.com/pdf/mHealth.pdf</a></td>
<td></td>
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<tr>
<td>44</td>
<td>Rapid Android</td>
<td>RapidAndroid allows users to use the Android phone as a mini-server, in addition to using it as an SMS client, allowing users in the field to enter data, to create surveys, and rapidly analyze data in the field. RapidAndroid is a complete two-way SMS solutions that unlike other tools on the market, allows for analysis and processing on the actual phone.</td>
<td>SMS</td>
<td><a href="http://www.mobilityactive.org/rapid-android-turning-android-phone-data-collection-and-supply-management-server">http://www.mobilityactive.org/rapid-android-turning-android-phone-data-collection-and-supply-management-server</a></td>
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## Blogs

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<thead>
<tr>
<th></th>
<th>Blog</th>
<th>Supporting Org</th>
<th>Type of Articles</th>
<th>Blog?</th>
<th>Specific to mHealth</th>
<th>Space for Comments</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>eHealth Intelligence Report</td>
<td>WHO</td>
<td>Published, Scientific</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Links to pertinent sources</td>
</tr>
<tr>
<td>2</td>
<td>infoDev Newsletter</td>
<td>infoDev (WB)</td>
<td>Summaries of studies/talks</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Communication Initiative</td>
<td>ICT for Dev.</td>
<td>Summaries of studies</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>mHealth Alliance</td>
<td>UN Foundation</td>
<td>Studies, Talks, Podcasts, Events</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Look at healthunbound.org</td>
</tr>
<tr>
<td>5</td>
<td>Med eTel</td>
<td>ISFTEH</td>
<td>Links to other Articles</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Mostly conference, newsletter about speakers with brief recently published articles section</td>
</tr>
<tr>
<td>6</td>
<td>IICD</td>
<td>IICD</td>
<td>Project Descriptions, Studies, News</td>
<td>Yes</td>
<td>No</td>
<td>Yes (on twitter)</td>
<td>Inrequent posting</td>
</tr>
<tr>
<td>7</td>
<td>mHealthnews</td>
<td>MobiHealthNews</td>
<td>Project Descriptions, Interviews</td>
<td>Yes</td>
<td>No</td>
<td>Yes (on twitter)</td>
<td>MANY posts and useful articles</td>
</tr>
<tr>
<td>8</td>
<td>Mobile Active</td>
<td>mobileactive.org</td>
<td>Applications, Reports, Interviews, Events</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>mdirectory.org - database of reports, projects, etc.</td>
</tr>
<tr>
<td>9</td>
<td>Balancing Act Africa</td>
<td>Balancing Act</td>
<td>News Articles</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>A leading provider of news in African technology media and telecom (TMT)</td>
</tr>
<tr>
<td>10</td>
<td>Rockefeller Foundation</td>
<td>Rockefeller</td>
<td>News Articles</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Leading donor foundation</td>
</tr>
<tr>
<td>11</td>
<td>Telecom Africa</td>
<td>Telecom Africa</td>
<td>Project Descriptions, Articles, White Papers</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Many of the site's links are dead (including mobile health), infrequent but relevant articles and the occasional white paper</td>
</tr>
<tr>
<td>12</td>
<td>Global Health Hub</td>
<td>PubHealth.org</td>
<td>News Articles on global health and re-posting from websites</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Posts news stories about health in world</td>
</tr>
<tr>
<td>13</td>
<td>HUB: Health UnBound</td>
<td>HUB is co-sponsored by the Health Metrics Network (HMH), hosted by the World Health Organization, and by the mHealth Alliance, hosted by the United Nations Foundation.</td>
<td>Blog posts and news articles</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>People/orgs sign up to be a part of the community focused on using tech for health; very few posts on blog; lists news articles from other websites each post focuses on specific country in Africa and a health issue; more focused on new ideas around health in Africa</td>
</tr>
<tr>
<td>14</td>
<td>AllAfrica</td>
<td>AllAfrica Global Media</td>
<td>New articles</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>IntraHealth Global Health Blog</td>
<td>IntraHealth</td>
<td>Blog posts and news articles</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>talks about health projects; opinions, re-posting, sharing favorite links; a few articles combining tech and health in Africa More focus on technology in Africa; not focused on health specifically</td>
</tr>
<tr>
<td>16</td>
<td>Afrinnovator</td>
<td>Afrinnovator</td>
<td>blog posts and news articles</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>17</td>
<td>Global Health at MIT</td>
<td>MIT</td>
<td>Information about health projects being run through MIT</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Talks about different field projects done by MIT students in Africa and other countries; some talk about using technology in health; all projects related to health</td>
</tr>
<tr>
<td>18</td>
<td>West African Health</td>
<td>West African Health</td>
<td>Posts about conferences</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Exhibitions and conferences; no blog; just a page for the conference</td>
</tr>
<tr>
<td>19</td>
<td>East African Community HEALTH</td>
<td>East African Community HEALTH</td>
<td>Press Releases</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Press releases; no real blog; deals with health in East Africa</td>
</tr>
<tr>
<td>20</td>
<td>TICsante (ICT Health) Foundation Orange</td>
<td><a href="http://www.ticsante.com/show.php/page-home">http://www.ticsante.com/show.php/page-home</a> Orange Telecom</td>
<td>News, Project Descriptions News about Orange Projects, Topics addressed by Orange (autism)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>In French In French</td>
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<td>Title</td>
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<td>1 Working towards mAfrica</td>
<td><a href="http://www.telecoms.com/17688/working-towards-mafrica/">http://www.telecoms.com/17688/working-towards-mafrica/</a></td>
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<td>3 Opportunities in Mobile Healthcare (mHealth)</td>
<td><a href="http://www.telecomcircle.com/2010/10/opportunities-in-mobile-healthcare-mhealth/">http://www.telecomcircle.com/2010/10/opportunities-in-mobile-healthcare-mhealth/</a></td>
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<td>4 TIC et système de santé en Afrique (ICT and the health system in Africa)</td>
<td><a href="http://www.ifri.org/downloads/ticetsystemedesanteenafrique.pdf">www.ifri.org/downloads/ticetsystemedesanteenafrique.pdf</a></td>
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<td>5 Implementing eHealth in Developing Countries</td>
<td><a href="http://www.itu.int/ITU-D/cyb/app/docs/e-Health_final_15092008.PDF">http://www.itu.int/ITU-D/cyb/app/docs/e-Health_final_15092008.PDF</a></td>
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<td>6 Establishing Partnerships to Promote eHealth in Developing Countries: Lessons from Africa</td>
<td><a href="https://www.ama.org/files/shared/Establishing_Partnerships_to_Promote_eHealth_0.pdf">https://www.ama.org/files/shared/Establishing_Partnerships_to_Promote_eHealth_0.pdf</a></td>
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<td>7 eHealth and Global Health: Investments Opportunities and Challenges for Industry in Developing Countries</td>
<td><a href="http://www.springerlink.com/content/en8574556405750/">http://www.springerlink.com/content/en8574556405750/</a></td>
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<td>8 eHealth for Africa: Opportunities for Enhancing the Contribution of ICT to improve Health Services</td>
<td><a href="http://www.google.com/search?q=EHealth+for+Africa%3A+Opportunities+for+Enhancing+the+Contribution+of+ICT+to+Improve+Health+Services&amp;ie=utf-8&amp;oe=utf-8&amp;client=firefox-a">http://www.google.com/search?q=EHealth+for+Africa%3A+Opportunities+for+Enhancing+the+Contribution+of+ICT+to+Improve+Health+Services&amp;ie=utf-8&amp;oe=utf-8&amp;client=firefox-a</a></td>
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<td>9 The RAFT network: 5 years of distance continuing medical education and tele-consultations over the Internet in French-speaking Africa</td>
<td><a href="http://www.jmjjournal.com/article/S1386-5056%2807%2900006-8/abstract">http://www.jmjjournal.com/article/S1386-5056%2807%2900006-8/abstract</a></td>
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<td>10 Building collaborative networks in Africa on health information systems and open source software development – Experiences from the HISP/BEANISH network</td>
<td><a href="http://dx.doi.org/10.125/355.132/scholar?q=cachey:yxaTf9npq6g4scholar.google.com/vICT+Health+Africa&amp;hl=en&amp;as_sdt=0.5">http://dx.doi.org/10.125/355.132/scholar?q=cachey:yxaTf9npq6g4scholar.google.com/vICT+Health+Africa&amp;hl=en&amp;as_sdt=0.5</a></td>
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<td>11 Communication Networking: ICTs and health information in Africa</td>
<td><a href="http://dx.doi.org/10.125/355.132/scholar?q=cachey:yxaTf9npq6g4scholar.google.com/vICT+Health+Africa&amp;hl=en&amp;as_sdt=0.5">http://dx.doi.org/10.125/355.132/scholar?q=cachey:yxaTf9npq6g4scholar.google.com/vICT+Health+Africa&amp;hl=en&amp;as_sdt=0.5</a></td>
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<td>13 Are ICT investments paying off in Africa? An analysis of total factor productivity in six West African countries from 1995 to 2002</td>
<td><a href="http://www.infosegaworld.com/smpp/content-db=all%content=p913387059">http://www.infosegaworld.com/smpp/content-db=all%content=p913387059</a></td>
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<td>14 ICT Research in Africa: Need for a Strategic Developmental Focus *Information Technology for Development</td>
<td><a href="http://www.infosegaworld.com/smpp/content-db=all%content=p912620350">http://www.infosegaworld.com/smpp/content-db=all%content=p912620350</a></td>
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<td>15 Experts Meeting on eHealth and Telemedicine Harmonization in Africa</td>
<td><a href="http://allafrica.com/storey/2011011930107.html">http://allafrica.com/storey/2011011930107.html</a></td>
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<td>18 Country Case Study for eHealth in Africa</td>
<td><a href="https://www.ama.org/files/shared/County_Case_Study_for_eHealth_South_Africa.pdf">https://www.ama.org/files/shared/County_Case_Study_for_eHealth_South_Africa.pdf</a></td>
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<td>20 Satellite African eHealth validation project</td>
<td><a href="http://iap.esa.int/news/SAHEL_News_21022011">http://iap.esa.int/news/SAHEL_News_21022011</a></td>
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<td>1</td>
<td>Alison Bloch, m-Health Advisor at GSM Association, Talks About m-Health Alliance, Mobile, &amp; SOCAP09</td>
<td><a href="http://www.youtube.com/watch?v=aAKcJwT9b6g&amp;feature=player_embedded">http://www.youtube.com/watch?v=aAKcJwT9b6g&amp;feature=player_embedded</a></td>
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<tr>
<td>3</td>
<td>Gabon leads the way to eHealth in Africa (deals with health insurance using a social welfare fund)</td>
<td><a href="http://www.gemalto.com/public_sector/healthcare/gabon.html">http://www.gemalto.com/public_sector/healthcare/gabon.html</a></td>
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<td>4</td>
<td>Grameen Foundation Ghana - Mobile Technology for Community Health initiative, e-health</td>
<td><a href="http://www.youtube.com/watch?v=YvY51gftqVQ">http://www.youtube.com/watch?v=YvY51gftqVQ</a></td>
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<td>5</td>
<td>Assignment Rwanda: Using Mobiles to Combat AIDS</td>
<td><a href="http://www.youtube.com/watch?v=P7qBnNjq7MQ&amp;feature=related">http://www.youtube.com/watch?v=P7qBnNjq7MQ&amp;feature=related</a></td>
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<td>6</td>
<td>Interview with Josh Nesbit: FrontlineSMS Medic On How Mobile Phones Save Lives (m-Health)</td>
<td><a href="http://www.youtube.com/watch?v=XwZlkN61rQY8&amp;feature=related">http://www.youtube.com/watch?v=XwZlkN61rQY8&amp;feature=related</a></td>
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<td>7</td>
<td>Bill Gates Keynote Highlights at the mHealth Summit</td>
<td><a href="http://www.youtube.com/watch?v=eABaojTw54&amp;feature=related">http://www.youtube.com/watch?v=eABaojTw54&amp;feature=related</a></td>
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<td>8</td>
<td>The Mobile Health Project, by Kilifi Kids</td>
<td><a href="http://vimeo.com/12592220">http://vimeo.com/12592220</a></td>
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<td>9</td>
<td>mHealth Summit 2010 - Thierry Zyliberberg (Orange Mobile)</td>
<td><a href="http://www.youtube.com/watch?v=TYteJuutBFQ">http://www.youtube.com/watch?v=TYteJuutBFQ</a></td>
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<td>10</td>
<td>mHealth Summit 2010 - Bright Simons (mPedigree)</td>
<td><a href="http://www.youtube.com/watch?v=jYA-k-5fXk5A">http://www.youtube.com/watch?v=jYA-k-5fXk5A</a></td>
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<tr>
<td>11</td>
<td>Wireless Reach South Africa Mobile Health Information</td>
<td><a href="http://www.youtube.com/watch?v=qryv7L8zc1">http://www.youtube.com/watch?v=qryv7L8zc1</a></td>
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<tr>
<td>12</td>
<td>Ozcan Group UCLA LUCAS CellImaging ScienceChannel Brink</td>
<td><a href="http://www.youtube.com/watch?v=HTC2k7p80rl">http://www.youtube.com/watch?v=HTC2k7p80rl</a></td>
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