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Michael Olsen	Date

Leaving the Bleeding Edge: An Industry Analysis of eSurveillance in Africa

In Support of the African Surveillance Informatics Governing Board

By

Michael Olsen
Master of Public Health

Global Health

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An abstract of
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Rollins School of Public Health of Emory University
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Abstract

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By Michael Olsen

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The promise of eSurveillance and eHealth (especially under the IHR and IDSR) is tremendous, but the African eHealth industry is plagued by structural inefficiencies. The Diffusion of Innovation (DOI) model is used to explain many of the trends of eSurveillance. These structural inefficiencies are precipitously slowing the adoption of eSurveillance, and they weaken surveillance systems. If these inefficiencies continue, they seriously harm the utilization of ICT in public health as envisioned in WHO's 2005 directive on eHealth. While there are many organizations looking to ease these conditions, the amount of support for government in certain areas is lacking. Specifically, these areas lacking support are: ICT training for government workers, public informatics training for government public health leaders, change management support, evidence on the impact of design options, and general advocacy for the adoption of eHealth. These areas were identified by risk analysis for governments engaged in eHealth projects and a competitive analysis of organizations designed to support those governments.

In addressing these problems, this report reveals an unmet need of governments investing in eSurveillance: that of a permanent, participatory network of government experts in information communication technology (ICT) and public health. Such a body would strengthen eSurveillance in three ways: it can effectively influence key stakeholders in governments; it pools risks and resources; and it builds social avenues to promote other strategies, such as IDSR and IHR. An international coordinating body such as the ASIGB may be in a position to address this unmet need.

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EXECUTIVE SUMMARY

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Report Details

The introductory section of this report outlines the very basics of ICT and Public Health. In addition to a list of the terms of reference, context is provided for disease surveillance and for ICT for readers who may not be familiar with basic concepts in either field.

Section 1 ("Broad Industry Overview") begins with a summary of the promised future state and an exhibit of how well **eSurveillance can enhance, enable, and empower IHR and IDSR**. Next is a look at the context and definitions of the term "eSurveillance." "eSurveillance" is a public health component of the larger field of "eHealth." **Fully realizing the promise of eSurveillance means breaking down silos in public health informatics/eHealth and investing on a large scale**. In fact, eSurveillance becomes effective only after a process of investment in other eHealth technologies takes place for African states. This report, therefore, examines the broader eHealth industry in Africa.

Section 2 ("eHealth Industry Trend Analysis") examines the current state of the eHealth industry in Africa. Because eHealth ideas are relatively new and untested, the analysis **models how ideas spread first from technology enthusiasts to the main stream.** The perspective used is from Diffusion of Innovation (DOI) research. **eHealth is clearly in the first stage of that five stage process: it is in what the model refers to as the "Bleeding Edge."** Many commentators have pointed out this is a very fragmented marketplace and planning environment; the overwhelming majority investment is spent on unsuccessful pilots by small NGOs. The market is also relatively small; estimates show that **investments in eHealth across Africa by all players represents less than 0.3% of total health expenditures, or 45¢ per capita**. Section 2 also contains a model summarizing the factors needed for success in eHealth strategies: Planning, People, Provision, and Process (4Ps).

However, the industry in Africa is progressing to the second stage of development, the "Leading Edge." There is a **movement towards national consolidation of eHealth programs and better quality of evidence to guide leaders**. But with this increased expectation comes increased potential for what DOI researchers call the "Adoption Chasm": the technology may not catch on and spread past the early adopters. The Adoption Chasm would be a very negative outcome, as eHealth holds much promise.

Section 3 ("Government eHealth Trend Analysis") examines the difficulties of the eHealth industry from a **governmental perspective**. While there are many excellent summations of the issues in the eHealth industry, there are fewer analyses that look at the **risks governments face when deciding whether to invest**. However, as this investment will drive eSurveillance, it is important to understand. A total of **19 risks across all 4Ps are ranked** based on a literature review. **Eight of these risks have the most significant impact**. Possible programs to address these risks are outlined.

Section 4 ("*Industry Gap Analysis*") looks at the work of **non-state actors** to move the eHealth industry forward. These "enabling organizations" (versus "implementing organizations") are catalogued and ranked by to a newly developed method (based on Competitive Analysis techniques) called "Weighted Measure of Reach", quantitatively combing organizational size, partnerships and focus into one measure that captures the activity of an organization. The **major players** in the field are identified, and the **sectors (e.g., NGOs, international agencies, foreign aid agencies) are profiled** based on this analysis. This analysis, combined with the risk assessment analysis in section 3, **identifies 3 areas where support of government interventions is especially weak**.

Section 5 ("Responses to Gaps in E-Health") examines next steps and possible strategic responses that an international coordinating body may take. The **most promising approach is building several sub-regional networks where civil servants from health and ICT ministries of similar countries can meet regularly and take up the most pressing eHealth problems to them.** These meetings, it is hypothesized, will serve as the most efficient way to speed the uptake of eHealth. Other frameworks to evaluate technology investment and standards establishment efforts are also shared.

A more complete, extended executive summary is included as well for easy sharing of ideas.

Extended Executive Summary

Overview

This report serves as background for the African Surveillance Informatics Governance Board (ASIGB) as its leaders set strategy. It utilizes business analysis frameworks and techniques to shed light on information and communications technology (ICT) as a tool to realize the disease surveillance goals of the 2005 International Heath Regulations (IHR) and Integrated Disease Surveillance and Response (IDSR).

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Vision of eSurveillance and IDSR

IDSR, IHR, and One Health have the same underlying philosophy as this report: these three successful frameworks have added structure, breadth, and capability to public health in Africa (1-3). These are needed to spur growth of eHealth in Africa.

The technology associated with eSurveillance will have a profound effect on IDSR implementations (4). Much of the technology needed is already in use in different projects across Africa (5), and more technologies are bound to come. The impact on each cell of the matrix shows the impact technology can have (see appendix 5 for a full account):

	Identity	Report	Analyze and Interpret	Investigate and Confirm	Respond	Communicate (Feedback)	Evaluate	PREPARE
Community	✓	✓	✗	✗	!	✓	✓	!
Health Facility	✓	✓	!	✗	!	✓	!	!
District, State, Province	✓	!	✓	✓	!	✓	!	!
National	!	✓	✓	✓	✗	✓	!	!
National WHO Representative…	!	!	✗	✗	✗	!	!	!

Key

Technology Applicable to each function	✓	Technology Applicable to some functions	!	Technology Not Applicable	✗

Figure 1: *IDSR matrix showing the impact of current technology on each set of activities*

Structure of the Industry

While most of the technology is already present in the field, the organizational capacity to successfully implement projects is missing (6). This is the fundamental problem that a coordinating body can address.

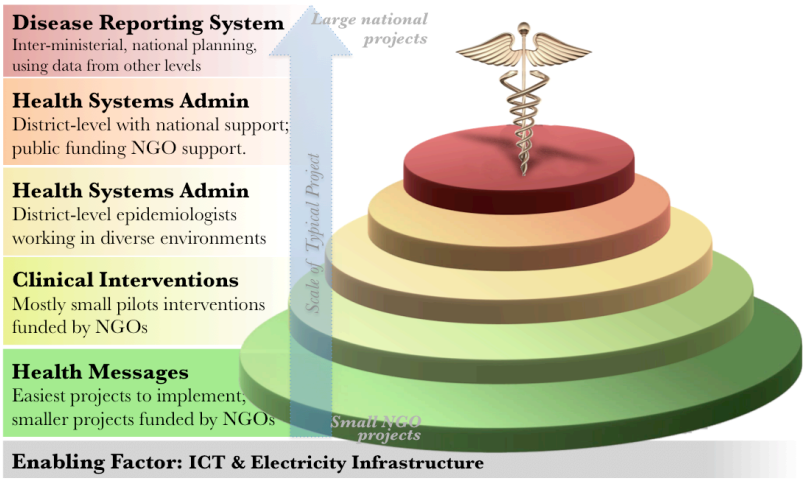

Figure 2: *The eSurveillance implementation pyramid*

In approaching a scope for analysis of eSurveillance, eSurveillance is blurring the line between clinical and public health approaches (7). It sits at the top of a pyramid. Many other eHealth activities are required to build capacity to support a comprehensive eSurveillance approach. Any organization approaching eSurveillance (especially from an IHR, IDSR or One Health perspective) will need a coordinated approach to eHealth as a whole.

The eHealth market is small (USD $382M), but growing fast (12-16% CAGR) (8). Currently, it is dominated by projects implemented by Non-Governmental Organizations (NGOs) and international agencies. In 2010, only 22% of all WHO-surveyed eHealth programs were funded by government; 47% of programs were funded by of donors and 25% were funded by out-of-pocket payments (9). As mentioned above, in its current "Bleeding The double-digit yearly growth is remarkable, especially considering that ITU estimates eHealth has seen over 90% of its projects fail in the past (10).

Drivers of Growth

1. **ICT Sector Growth**: The technology sector as a whole has grown tremendously in Africa, and that industry growth spills over into health (11).
2. **Overburdened Healthcare System**: There's a great demand by citizens to improve the healthcare system, but money is short and healthcare workers are few (12, 13). Technology may maximize efficiency.
3. **eHealth in Global North**: eHealth in North America and Europe is nearly a $100 billion dollar industry (8); easy portability of technology leads to spillover to the Global South.
4. **Faith & Excitement in Technology**: People around the world are fascinated by health technology and believe it can solve myriad problems (14).

Establishing effective eHealth systems is very complex, and experience in the EU shows that countries underestimate the complexity (15). This report organizes factors involved in successful eHealth strategies into four domains: People, Process, Planning, and Provision. The full map is presented in figure 3.

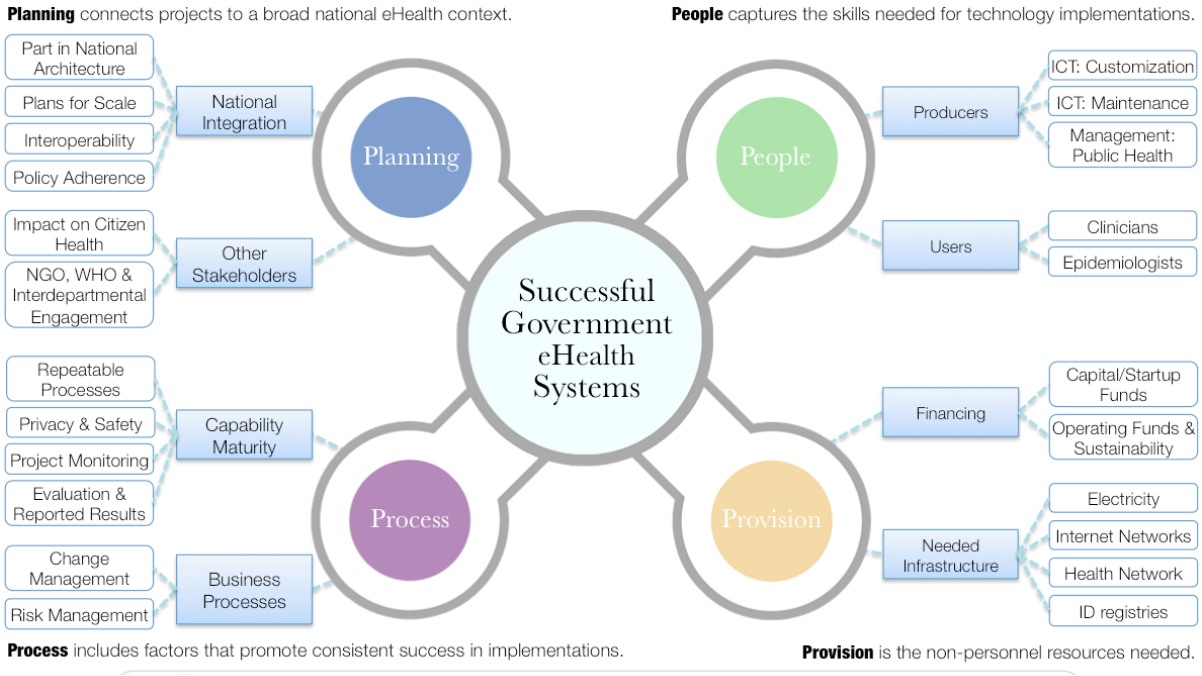

***Figure 3**: The 4P model of eHealth Systems*

Note that technology (the equipment and software) is a secondary factor to success (6). Costs of computers and mobile phones have plummeted over the past decade. There are a host of technology projects very well implemented and open-sourced. The other factors (Process, Planning, People and Provision) need to catch up to technology (16).

Features of Growth & Maturity in the eHealth Industry

As eHealth has tremendous potential to transform public health in Africa, the WHO and other international agencies have promoted adoption of national eHealth strategies by governments in Africa (17, 18). A success framework to propel these efforts is Everett Roger's Diffusion of Innovation (DOI) model (19), describing how groups adopt new ideas and providing guidance on achieving quicker and more complete adoption. Roger's work and subsequent add on research (20-23) outlines five stages of adoption by a group, beginning with a "Bleeding Edge" stage and proceeding to the "Cutting Edge" stage. Geoffrey Moore added to the model, pointing out that many innovations proceed through the first two stages and then fail to reach the "Majority Adoption" stage—they fall into the "Adoption Chasm" (24).

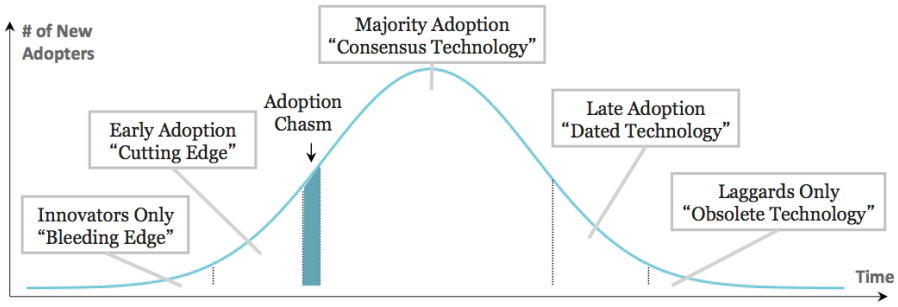

***Figure 4**: The adoption curve*

Applying the DOI model makes it is clear that eHealth industry in Africa is in the bleeding edge phase of eHealth and eSurveillance. In analyzing current African government eHealth systems, this report finds that each of the 4Ps (Planning, People, Processes & Provision) demonstrate classic bleeding edge characteristics. Yet, there is some evidence that the leading edge phase is approaching:

Bleeding Edge and Leading Edge Aspects of eHealth

Bleeding-Edge Aspects Today:

- **Lack of National Strategies**: Only six countries have up-to-date eHealth strategies, according to the WHO's analysis (25, 26).
- **Proliferation of small pilots that never achieve larger scale**: In eHealth's history, more than 90% of eHealth projects have failed (10).
- **Supply-side driving growth**: in general, it is not the governments but NGOs that identify problems and develop ideas for eHealth projects (16). The problem is so sever that eHealth is said to jokingly to suffer from a disease: "Pilot-itis" (14, 27, 28).

Signs of a Transition to the Leading Edge Stage:

- **Examples of national consolidation**: Uganda and South Africa have imposed moratoriums on eHealth projects to review each and ensure they comport with national strategies (29).
- **Examples of international coordination**: Partnerships in eastern, southern and central Africa (as part of a broader movement of sub-regional coordinating disease surveillance networks) have each addressed at least some aspect of eHealth projects (30, 31).

Bleeding-Edge Aspects Today:

- **Lack of expertise to implement eHealth projects**: Ministry of Health ICT staffs are chronically understaffed. Ethiopia and Uganda, for example, each have fewer than 5 developers in the national department of each country (32). These countries together have a population of 113 million (33).
- **Lack of eHealth awareness among health workers**: Studies in Ethiopia (34) and Nigeria (35) have found less than half of medical worker with working familiarity of eHealth.
- **Pilot designers and scale-up champions typically will come from different professional worlds**: Typically, pilot projects are run by entrepreneurs or technologists, while decision-makers in ministries are medically trained. This gulf in communications and outlook can have a negative impact on successful scale-up strategies (16).

Signs of a Transition to the Leading Edge Stage:

- **Uptick in national investment in ICT**: Both Kenya and Rwanda have significant government policies to nurture an ICT industry, which will have spillover effects in eHealth staffing (36).
- **More training opportunities**: Several institutions offer informatics programs, and they are proliferating across Africa (37).

Bleeding-Edge Aspects Today:

- **Marked under spending on change management**: In non-health ICT projects, adequate change management should account for 15% of budgets. However, eHealth low-resource settings require more resources. The Commonwealth estimates that 40% of expenditures on an project should be spent on change management (38). In practice, it change management is often never even discussed in a project (39).
- **Lack of evidence on what works**: A comprehensive 2010 review of 2,043 citations on eHealth found only 32 controlled studies (40). The lack of studies is pronounced in eSurveillance.

Signs of a Transition to the Leading Edge Stage:

- **More Randomized Controlled Trials (RCTs):** In November 2012, 215 RCTs in eHealth were underway, a 24% increase in 6 months (14).

Bleeding-Edge Aspects Today:

- **Few sustainable financial models:** Donors fund most projects (16), and cost-effectiveness data of implementations is very rare (41).
- **eHealth requires capital while most of health systems spending is on operating costs:** Salaries and medicine typically dominate health systems' expense reports, but eHealth requires capital expense and upfront money (42). This different type of spending may prevent smaller stakeholders (district-level or smaller governments) from undertaking larger projects.

Signs of a Transition to the Leading Edge Stage:

- **Exploration of new models of financial models:** Examples include providing Community Health Workers solar chargers so they can sell mobile charges to neighbors and subsidize their text messages with the system (43), or raising funds from pharmaceutical companies to fight counterfeit drugs.
- **More availability of capital in the ICT field:** New venture capital funds are being established, especially out of Nairobi (44).

The Perils and Potential of eHealth Implementation

The widespread use of ICT in health will happen eventually, but full use may take decades longer than expected. The history of the eHealth industry is filled with failures—over 90% of projects, according to the ITU, have failed (10). Despite some encouraging signs of eHealth in Africa, there has been a Gold Rush in eHealth—investment by a lot of parties without much to show for it.

The Adoption of Innovation model suggests there is a chasm coming. If the potential of eHealth is not proven to countries that are deciding on adoption, investments will be delayed, possibly by decades (6). The future will bring

further fragmentation and slowed innovation. eSurveillance, as it builds on other disciplines, is the most likely victim of this chasm. Ultimately, a future of eHealth falling into a chasm is a future with more emergent diseases (45).

Alternatively, there is another more optimistic possibility: more countries may make a commitment to adopt eHealth with adequate funding and personnel. New technology tools will emerge and costs will decrease. The chasms of adoption that put the implementation of eSurveillance in danger may be filled with a strong intergovernmental network of epidemiologists and career public health civil servants. These health systems can deliver on their promise of good health for their citizens.

If the eHealth industry does not achieve optimistic view of ICT usage, Africa will be in poorer health and the world will be faced with more emerging diseases.

Risks to Governments in the eHealth Industry

With severe financial and organizational challenges associated with national health systems in Africa, asking countries to invest in eHealth is asking them to take on tremendous risk (46). Outlining these risks from a government perspective provides a view of need for assistance in this emerging eHealth area for outside organizations aiming to help. Below are the risks for each of the four domains discussed above—planning, people, process and provision. See the figure 5.

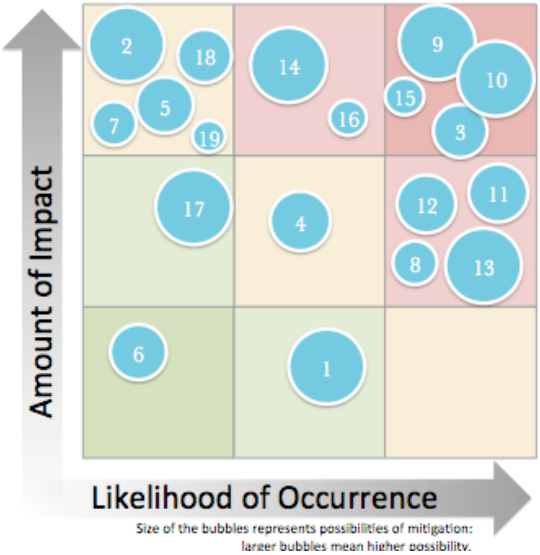

***Figure 5**: Risk Impact & Probability Chart. Numbers in the bubbles correspond to the risks listed in tables on the right.*

Planning Risks

1	First Mover Risk
2	Sovereignty Risk
3	Complexity Risk
4	Policy Risk
5	Scaling Risk
6	Standards Risk
7	Constituency Risk
8	Collaborative Risk

People Risks

14	Technical Risks
15	Management Risks

Process Risks

9	Maturity Risk
10	Adaption Risk
11	Impact Risks
12	Disaster Risk:
13	Customization Risk

Provision Risks

16	Funding Risk
17	Overspending Risks
18	Infrastructure Risk
19	Sustainability Risk

Enabling Organizations in the eHealth Industry

There are two domains of organizations working in eHealth in Africa: implementing organizations that run eHealth projects and enabling organizations that help implementing organizations do their work. This report's emphasis is on enabling organizations. To provide a comparison of the field, a "Weighted Measure of Reach" (WMR) was calculated for 71 identified enabling organizations. (The WMR is based on organization size, partnerships, organizational formality, and focus on the use of eSurveillance in Africa; the scores are used to compare strategic groupings in the eHealth industry. Those enabling organizations were broken up by domain of work (e.g., funding, research, ICT training). This exercise reveals four insights, as outlined on the following table:

Insights from Domain Stratification

1. **Funding—the most active area of support**: Providing funds to address health systems strengthening is clearly a central function of the Enabling community. The second area of support is scientific research into eHealth topics and third is promotion of discussion between technical implementers of eHealth.
2. **Technology—well provided for by enabling organizations**: Many organizations on the list have pilot projects or wide-ranging implementations (such as HISP's open sourced DHIS2, used as the national surveillance system in 8 countries). It does not seem that a lack of technology is a problem.
3. **Increasing number of networking organizations**: Rockefeller Foundation and WHO's Health Metrics Network lead the networking category, but several sub-regional organizations (in east, central and southern Africa) have been founded in the past years, representing a new interest from member states in sub-regional cooperation on disease surveillance.
4. **Need for advocates**: There are only two organizations in an advocate's role, but the need to convince and "sell" to governments.

Enabling organizations can also be grouped by the governmental risk their services address. If we isolate the organizations that only focus on governments, we can identify several risks that are not well addressed:

Top Risks

1. **Change management & adaption risks**: While 95% of projects with strong change management hit budget and organizational goals, only 15% without change management succeed (47). Few organizations provide governments change management support.

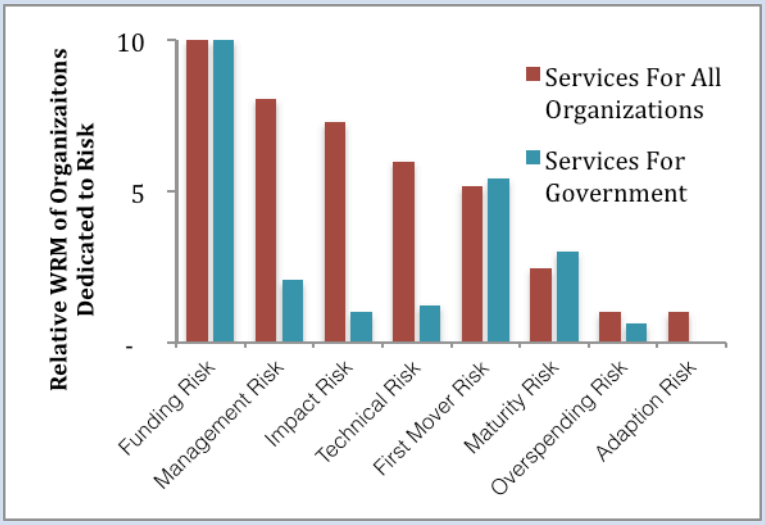

***Figure 6**: Services provided by enabling organizations in the eHealth Industry, across several risks*

2. **Risks associated with uncertainty in budgeting**: In national eHealth projects in Europe, countries faced constant overruns in budgets (15). But there are few resources to assist African governments in overruns.
3. **Risks stemming from a lack of expertise**: Several organizations with reach provide training, but few provide these expert trainings directly to government workers—generally, it is general training to the population at large.
4. **Risks from a lack of evidence**: While there are more studies on whether certain interventions are successful, there are fewer studies on the actual choices governments make—for instance, whether to use technology A or technology B (48).

Opportunities to Fill Gaps in the Industry: Networking

According to the expanded DOI model, the eHealth industry is facing an "adoption chasm," leading to fragmentation and reduced innovation. More countries need to be convinced to adopt the technology: if enough countries are experimenting and sharing those experiences, the industry will avoid the chasm and move forward.

An opportunity to do this is in networking—specifically, through sub-regional networks of career public health and ICT civil servants. Analysis outlines the missing pieces in this effort. Analyses of two other responses—technology investment and support of standards—are included as an appendix. Technology investment is very, very risky and not as needed as other efforts. Setting standards is an excellent goal, and a network structure provides a smart platform.

There is tremendous research on formal and informal network building within the global health domain (31, 49, 50). Especially instructive in the global health network is the relatively new movement of sub-regional disease surveillance networks. The successful networks utilize trust-building techniques and feature sustained relationships of three types of public health leaders, built in a face-to-face context, utilized to solve problems of international coordination in disease surveillance (49). A coordinating body is well positioned to fill each of the three roles in diffusion outlined by the DOI model (51): see figure 7.

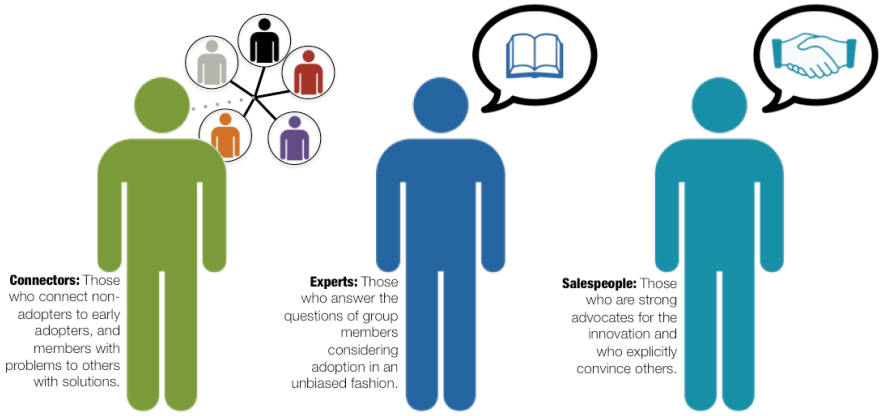

***Figure 7**: Three roles a coordinating body can fill in the diffusion process*

The impact of a strong network can be profound—both for governments investing in eHealth and for the organization that is responsible for building such a network. For government, the positive benefits can include:

1. A network can mitigate a slew of risks for eHealth-implementing countries.

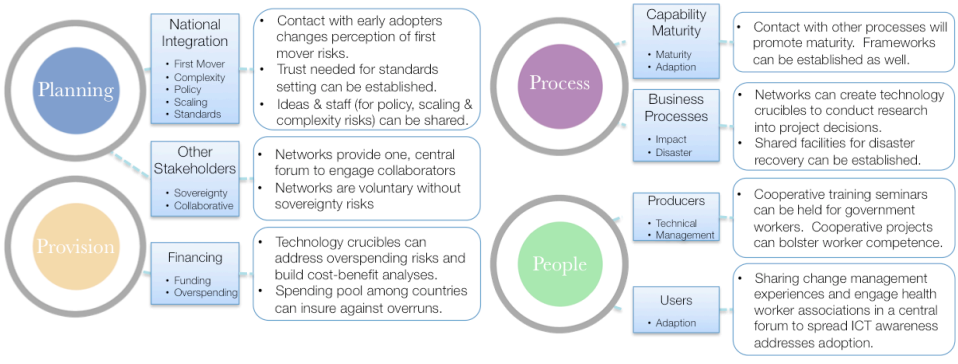

***Figure 8**: Risks a strong participatory network can solve*

2. Strengthening national networks will strengthen national systems, especially in IDSR and IHR projects.
3. Research shows that peer sharing is the best way to quicken adoption of a new idea (23).

Likewise, there are three positive benefits to the convening organization:

1. Such a network would not be completely novel; it would build on CDC & WHO/AFRO experience.
2. Funders will support the organizations with the closest ties to multiple governments.
3. A networking infrastructure provides a clear purpose but in a capacity designed to grow.

Introductory Materials: The Very Basics of Public Health & ICT

TERMS OF REFERENCE

Disease Surveillance: a practice in epidemiology that monitors the distribution of health outcomes to support effective response or prevention of that disease or exposure (52). The actual response is often considered a part of the definition.

eHealth [Electronic Health]: as the WHO defines it, "the transfer of health resources and health care by electronic means", encompassing ICT in three areas: the delivery of clinical health care, improvement of health services through education, and management of health systems (17).

EMR or EHR [Electronic Medical Record or Electronic Health Record]: patient medical records maintained on a computer and stored in a database. When part of that record is accessible or updatable (e.g., over the internet), it is considered an EHR.

eSurveillance [Electronic Surveillance]: as defined in this report, "the systematic application of information and communications technology (ICT) across health, veterinary and other systems to: 1) improve the timeliness, accuracy, cost, completeness, reliability of information available to public health decision makers and 2) improve the timeliness, effectiveness, cost and reliability of systematic responses to health needs of a population." eSurveillance is a term not generally used in the literature; PHI or eHealth for disease surveillance cover the same concepts.

ICT [Information and Communication Technology]: the application of communication and internet technologies. The term Information Technology (IT) is used more often in the United States and is nearly equivalent.

IDSR [Integrated Disease Surveillance and Response]: a framework designed to implement public health surveillance and response systems in the WHO/AFRO region. The framework is meant to engage all parties from the community, local clinics, the district level, and the national and WHO levels (3).

IHR [International Health Regulations]: an accord governing responsibilities of nations in international disease surveillance. The World Health Organization passed a revision of the IHR in 2005 that outlines when the 194 states party to the accord must report disease outbreaks to the WHO. The IHR requires member states to enhance their capabilities for public health surveillance and response in eight core capacities (53).

ITU [International Telecommunications Union]: a United Nations agency, the ITU is a specialized agency for ICT; it establishes standards in communication, coordinates global communication infrastructure, and promotes use of ICT technologies that promote development.

Interoperability: a specific example of standards regarding the ability of computer systems to talk to each other in the same language. Interoperable computer programs will be able to output their data so any other computer programs subscribing to the same standards can read that data. This means structuring the data messages in a certain way (structural or syntactic interoperability) and having standard terminology and case definitions (semantic interoperability) (54). Given the thousands of projects in eHealth, technical interoperability is difficult (55).

mHealth [Mobile Health]: the use of mobile phones and mobile technology to improve healthcare. Mobile phones have proliferated across Africa to be by far the most popular technological platform, and clinical mHealth is perhaps the most active area of eHealth investment.

One Health: many emerging diseases are originate in animal populations: SARS, Avian Flu, Swine Flu and even HIV/AIDS all crossed to the human population from animals (56). One Health is an interdisciplinary approach (including the public health, lab sciences, zoological, agricultural and medical fields) to address this threat to human, environmental and animal health (57).

Open Source Software: software that is free to use or customize. Whether done for charitable reasons or based on a business model, open source projects generally have remote teams working together to improve the code.

PHI [Public Health Informatics]: as defined in the literature, "the systematic application of information and computer science and technology to public health practice, research, and learning" (58).

Smart Phones: hand-held computers with large touch-screens that also serve as phones. The Apple iPhone is the most well known smart phone. An "Android" is related—it is not a Smart Phone, but it is the operating system (software that runs the phone) for some smart phones. There are other operating systems, but iPhones or Android-run phones together dominate the market.

SMS (Text Messages) [Short Message Service]: short (160 character) messages sent between phones, or between a phone and a computer, if an SMS modem is used.

Standards: the minimum requirements for any system, ICT or not. Standards might include minimum security and privacy requirements when storing paper records, or minimum functionality for a specific piece of software (54). The term is often applied to ICT systems, but the IHR is an example of standards. In ICT, "Interoperability" is a type of standard. Given the thousands of projects in eHealth, establishing one standard that is followed is a large undertaking (55). Standards are typically established as norms within a community, until governments or funders codify and require adherence to a set of regulations (22).

Tablets: flat computers with large, touch-screen monitors, expensive but very versatile for information display and capture. The Apple iPad is the most famous tablet.

WHO/AFRO [World Health Organization's African Regional Office]: the WHO coordinating body for 42 countries in Africa. (Most countries that could be considered "Middle East" are part of other WHO regions).

Quick Primer on eSurveillance and eHealth

Summary: This report is not aimed solely at technical experts; it is meant for members of public health and technology leadership in Africa. Therefore, basics of eHealth are described, as well as the context of disease surveillance.

The "Terms of Reference" list above may also be useful for readers to understand terms associated with eSurveillance.

What is the context of disease surveillance in Africa?

National funding in Sub Saharan Africa increased by about 80% in the 2000s, to USD $29.4B. Outside funding for health in Africa has increased nearly seven fold between 2000 and 2010 to USD $8.1B, although growth has stagnated since then. Much of this funding is directed (oftentimes by donors, not governments) towards disease-specific programs, such as anti-HIV/AIDS or anti-malaria initiatives(59). Disease surveillance is the responsibility of nations; organizations like the WHO assist countries in developing systems and in international coordination of outbreaks (60).

Two important strategic developments in the past 10 years have been IHR and IDSR. **IHR** (International Health Regulations) was updated in 2005 (largely in response to SARS) setting out **requirements for international disease surveillance and information sharing**. IHR also requires member states to enhance their capabilities for public health surveillance and response in eight different core capacities (60). **IDSR** (Integrated Disease Surveillance and Response,) re-endorsed by WHO/AFRO members states in 2006, is a **framework to implement public health surveillance** and response systems in the WHO/AFRO region. It provides techniques, tools, and benchmarks to engage stakeholders involved in public health, from a local community to the WHO and national public health leadership (1, 3).

What is the context of eHealth?

History of technology use: The lineage of eHealth can be traced back to the 1960s and 1970s when small projects were initiated in telemedicine—using radio or phones to provide medical care from a distance. No project was especially successful, and those early failures deflated expectations for the field for at least a decade (61). Moving to the late 1990s, as Europe and North America started experimenting in the field, smaller projects installed computers into some hospitals in Africa replacing paper charts and processes with Electronic Medical Records (EMRs) (62). "eHealth" expanded in the

mid 2000s with "mHealth", or the use of a developing mobile phone network (with 63 subscriptions per 100 people by 2012 (63)) to improve medical care. Small NGOs led this charge in Africa (16); private health care organizations and governments led this process in the Global North.

Significant meetings include:

- In 2005, the WHO passed a resolution prompting states to use eHealth technologies; since that time, the organization has made investments in promoting standards and understanding the field across the board (17).
- In 2008, the Rockefeller Foundation, a leader in supporting eHealth, held the Bellagio Conference, which brought together a range of Public Health and ICT experts for several weeks of meetings, outlining many of the problems to widespread eHealth adoption and establishing many partnerships in the nascent field (64).
- Since 2008, there have been several other eHealth conferences for government leaders, technologists, public health experts and professional societies.

Technology: In the past decade, there has been huge proliferation of technologies in Global South eHealth, some using very complex database-driven solutions, others using simple 160-character text messages (56). There is less understanding of how to properly implement and customize the technology that already exists without "reinventing the wheel" (65).

This report is about eSurveillance. What is eSurveillance?

eSurveillance is the use of ICT (Information & Communications Technology) to improve epidemiologists' understanding of disease in a country and to improve their ability to respond. This includes everything from scanning news sites for hints on unknown outbreaks to compiling reports to find symptoms that match disease profiles to supporting efforts to quickly immunize a local population (7).

Larger context of eHealth: But there's a larger context, and setting a scope is important in this field.(55) In health, ICT can also help provide clinical care from a distance, offer public awareness campaigns over text messages or managing the pharmaceutical supply chain. A lot of that activity can feed into eSurveillance; ICT in health breaks down a number of silos. Therefore, this paper sets the scope at "eHealth", with a special focus on eSurveillance.

Examples: What does ICT do disease surveillance?

Practical examples of the use of ICT in disease surveillance and response include:

1. **Outbreak Notification**: A group of experts (ProMed-Mail) reviews reports of disease outbreaks or acute toxin exposures and distributes email alerts to 20,000 experts (for free). A group out of a Boston hospital (HealthMap) takes information from sources like ProMed and puts it on Google Maps, making it widely available on the internet. CDC-led initiative (The Global Public Health Intelligence Network, or GPHIN) monitors internet news websites for indications of outbreak/exposure and issues reports to subscribers. Another system (Global Animal Information Systems, or GAINS) aggregates reports from collaborators around the globe that collect and test samples for avian flu (45).
2. **Clinical Reporting**: A $40/clinic program in Kenya (Kilifi Kids) allows clinic workers to relay disease tallies to the central district office over text messages (SMS); a central server uses an SMS modem to receive, aggregate, and relay tallies to the national database. Missing reports are followed up by staff (43).
3. **Immunization Response**: In Millennium Villages, Community Health Workers send text messages to a server to register the address and vital stats on all of the under 5s in a village. Those stats are updated by CHWs, and a computer is used to look out for danger signs of mortality or disease. In response to a measles outbreak, health workers had a very accurate registry of children, assisting in achieving 99% coverage within three days of the beginning of an immunization program (66).
4. **Future use**: Smart phones and tablets are being discussed as useful technology for clinicians or others. Prices for phones are decreasing. Using data like the number of people searching Google for information about health trends or mining social sites like Facebook/Twitter has made headlines in the Global North; it may become worthwhile in the Global South as internet usage increases (67).

What does a typical eHealth project look like?

There are hundreds of small eHealth projects across Africa (16, 68). The ITU in 208 provided a succinct summary of the eHealth project life cycle, which is presented below (10).

Typically, an NGO (or a researcher connected with an NGO) in a rich country identifies a problem and develops an idea for a project—for example, if the problem in their communities is residents not returning for follow-up appointments, the project may be to use mobile phones and Community Health Workers to track down those individuals. This idea is

attractive to the organization, because it is high profile—potential donors appreciate technology. However, this type of supplier driven innovation may not match local needs or fit into broader government strategies (69).

The first step is a pilot to test whether this idea might work in an African setting. The long-term plan is to roll it out across a country or across the continent.

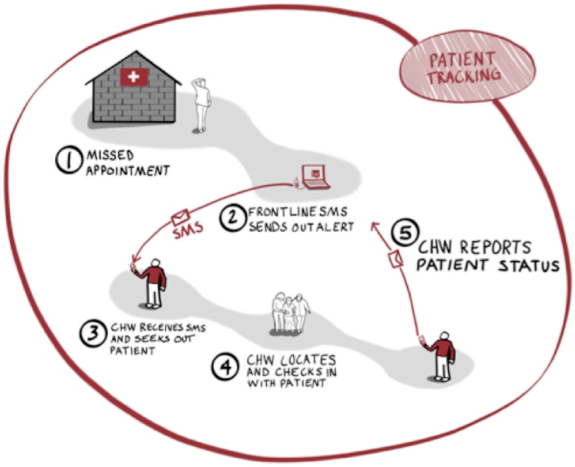

***Figure 9**: Workflow of a typical eHealth project*

Pilot Initiation

Planning: The staff will find a clinic or hospital or district health ministry to help it, and develop a memo of understanding to run the pilot. The clinic or staff has a relationship with the NGO and see the possibility in the project as it is outlined. No sign-off from the national level is needed or sought.

People: The NGO provides all of the technical work: programmers are brought onsite. Teams can range from two people upwards, and most projects do not have programmers from the country in which they work.

Process: A working group of government staffers, healthcare professionals, and NGO staff is formed and enthusiastic for six months. The "rough draft" of the program is completed, and it is time to train the health workers involved. Training then takes place with the people who are to use the system, and it is often is the case that those being trained have never seen the system and may have a foggy understanding of its use. New mobile phones (sometimes costing upwards of $150 a piece) are provided to all participants, who are mostly familiar with text messaging. Meanwhile, the NGO publishes a few whitepapers on its promising approach.

Provision: The NGO may find a grant to cover operations for one to three years.

Ongoing operations

During implementation, oftentimes problems in infrastructure arise, especially in electricity. Missing or broken phones are also issues that increase costs to the implementing organization. Also, adopting the system becomes difficult, as literacy levels (technological literacy and basic reading) can be lower than planned.

Over the next two years, the project provides positive results—referrals to the local clinics have increased three fold. Stakeholders are pleased with this. The real health impacts are difficult to document; they may exist, but evidence has not been collected in a systematic way. The project reaches a decision point as initial funding has run out; the volume of text messages becomes expensive and ongoing maintenance was underestimated.

The local health ministry has higher priority items to fund than this project, and the NGO staff has moved on to starting new pilots for different problems. While there were meetings about scaling up the project, costs would be very high if applied to the entire country. The local community sees the end of another promising project that will bring them "development."

Larger Context

The prototypical project displays many of the hallmarks of poor planning and communication that can be seen in the field. An outside party choses a problem and, not planning for the long term, initiates a project without sustainable funding, runs into unforeseen issues, does good, but cannot sustain the project or scale it up.

However, especially in the last three years, many projects have been designed to avoid these problems—new sources of funding and electricity are provided (70, 71) (using solar panels to charge phones and provide microbusinesses), or existing tools are used to keep costs down. National governments are also organizing in the field and establishing priorities, with the assistance of enabling organizations like the ITU (72, 73).

Section 1: Broad Industry Overview

eSurveillance & IDSR: What the Future May Hold

Technology in use today will assist health systems across the whole IDSR spectrum.

Summary: Below, a summary is presented of the impact that a full range of eHealth technology will have on IDSR. Much of the technology needed is already in use in different projects across Africa, and more technologies are bound to come. The impact is nothing short of remaking the possibilities of the IDSR framework. A full appraisal is presented in the appendix.

Figure 1.1*: The myriad registries and paper reports typical in a disease surveillance system*

Public health leaders talk about "eHealth" like they're referring to a far away land: it's a place we can reach, but no one quite knows the way to get there, and no one knows what we will find when we do reach those shores. "eHealth" or "eSurveillance" often turns into a goal in itself. But technology should not drive public health: health outcomes should.

Given the tremendous work done in the past 10 years, both in surveillance frameworks (with IHR & IDSR) and in eHealth projects, that ideal future is clearer now than it ever has been.

Specifically, a future with robust, reliable eSurveillance technology is not a future of technology doing the work, but of technology allowing epidemiologist and health workers to work more effectively (74). eSurveillance will begin by translating paper processes to electronic processes, but will eventually obviate the need for routine reporting, as electronic health records can be polled on a national, district, or health clinic level for aggregated data. In concerning areas, clinicians can be automatically prompted to collect new detailed information. Data can be analyzed to look for

systems or clinicians that are not performing to standards, as to provide more training. Community leaders can be notified by SMS or other electronic needs to improve local ties during adverse events. Financially, these systems make sense: any investments are recouped through savings produced by more efficient health systems. Over the long term, ICT will save money, not cost money (42).

A more complete account of eSurveillance's current technologies and eHealth's place within IDSR is presented below. In describing this future state, a few points become clear:

1. **eSurveillance will strengthen IDSR**: Almost every IDSR core function (33, or 82.5%) will be facilitated by a robust eSurveillance system.
2. **Most of the technology needed to support IDSR is already available**: Open source software in eSurveillance and in clinical interventions is used in various contexts across Africa. In each case where technology can be utilized, the technology already exists, is open sourced and is used in multiple implementations currently. The difficult task now sorely needed is the cost-effective implementations and adaption to local contexts, not the development of new technology (75).

The crossover between eSurveillance and IDSR is powerful and easy to see.

There are many eHealth technologies being used to support disease surveillance and IDSR; the East African Community, for instance, outlined several systems in use in Kenya, Uganda, Rwanda and Tanzania (for instance, Kenya's KEMRI-NUITM Demographic Surveillance System and Kenya-KEMRI Cancer Registry; Rwanda's mUBUZIMA community based surveillance; Tanzania's e-IDSR, Uganda's mTRAC) (5). Below, the processes in the IDSR matrix(3) have been mapped to existing software packages that are open source and used in multiple implementations. All packages are used in Africa, except for PAHO's eLearning materials.

Most functions can be completed or improved by technology; the obvious exceptions are those functions of decision-making or multifaceted management oversight that need professional, non-formulaic judgment. Below, the matrix itself is presented and categorized as to whether technology can augment all processes in each activity bucket, some activities, or no activities. A full account of each square is presented in Appendix 5.

It should be noted that the software chosen does not represent the best software available—no formal evaluation of alternatives was undertaken. These examples are simply meant to illustrate the possible future that eSurveillance combined with IDSR might bring.

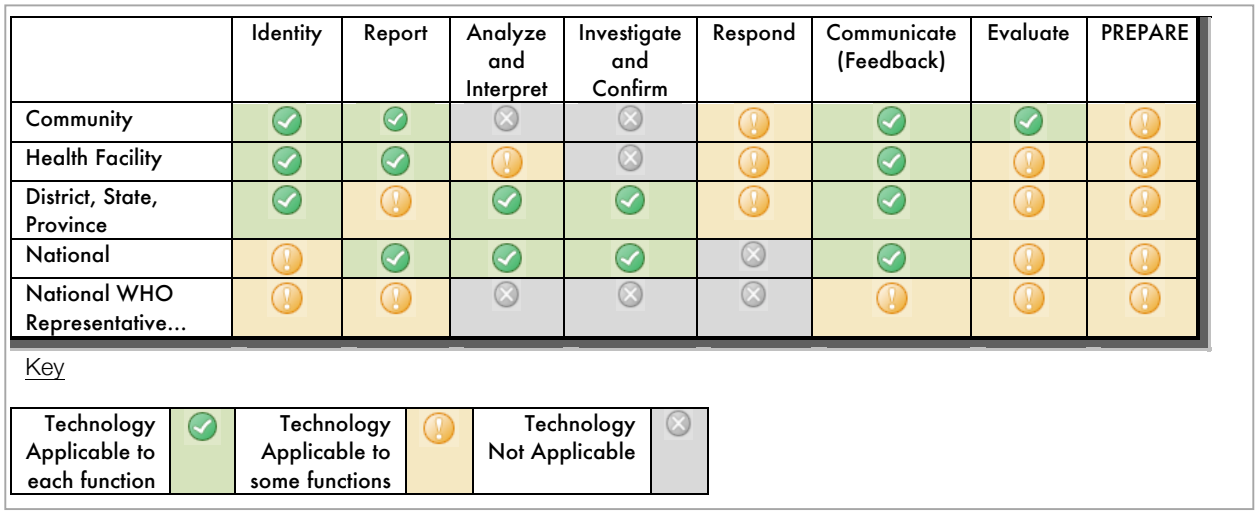

***Figure 1.2**: IDSR matrix showing the impact of current technology on each set of activities*

DEFINITIONS OF eSURVEILLANCE AND eHEALTH

eHEALTH AND eSURVEILLANCE ARE DIFFICULT TERMS TO PIN DOWN.

***Summary:** The eHealth and eSurveillance fields are new: while some terms have been around since 1970, new technology leads to new nomenclature. The "eHealth" field is a jumble of overlapping approaches. The term "eSurveillance", it must be noted, is hardly ever used: the WHO, for instances, uses "disease surveillance" as a branch of eHealth. This report defines "eSurveillance" to encompass both disease surveillance and response.*

Efforts to coordinate member state activities will be required to define the scope of its mandate: Will the aim be to support any use of ICT in health or will efforts be in a narrow band of application? Likewise, this analysis also must define its scope. The first step in that scope setting is in defining terms.

Nomenclature in the health information field is a jumble.

This report focuses on the concepts of "eHealth" and "eSurveillance" (with the "e" standing for "electronic"). The topics discussed are in a new field with a very wide range of applications; this often leads to a jumble of subfields, terminology, and operational areas. Health information is no exception. The term "medical informatics" was defined as far back as 1970, though computers were mainly used then to perform calculations on medical data. The current field of informatics focuses on capturing and retrieving information.(76)

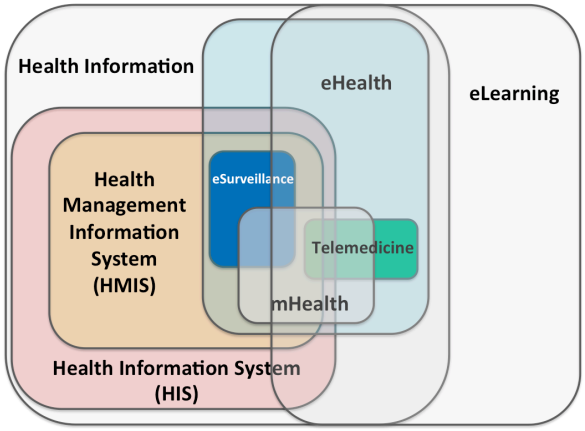

***Figure 1.3**: Overlapping terminology in Health Information. See Terms of Reference for definition of HIS, HMIS, mHealth and Telemedicine. Credit: Public Health Practice, Inc.*

Within this scoping discussion, definition of terms becomes more confusing as both of "eHealth" and "eSurveillance" are relatively new terms and at least "eHealth" is used differently by different organizations. There is no standard definition of

eHealth or eSurveillance. In fact, the breakdown of health information disciplines is a confusing nest of overlapping terms. See figure 4 for an illustrative diagram.

Important players use other terms for eSurveillance.

Our focus, eSurveillance, is a term that is used sparingly in academic literature; a Google Scholar search turned up a mere 15 mentions in the past four years. The most references come from CDC (77) and Australia (78).

Two other terms describe the similar concepts: Public Health Informatics and eHealth Disease Surveillance.

A. Public Health Informatics – Defined in several different ways in the academic literature, a consensus approximation of Public Health Informatics (PHI) is to be "the systematic application of information and computer science and technology to public health practice, research, and learning."(79)

PHI is used by CDC; all of the divisions of the CDC's Public Health Surveillance and Informatics section focus on some aspects of disease surveillance. But used by others, PHI can include informatics support of any public health functions, including spreading of health promotion messages, trainings of clinicians to provide preventative care, or information for evidence-based decisions.(80, 81)

B. eHealth in the "disease surveillance" subdomain: The World Health Organization favors the concept of "eHealth", which it defines as "the transfer of health resources and health care by electronic means," encompassing ICT in three areas: the delivery of clinical health care, improvement of health services through education, and management of health systems.(82) The scope of eHealth is health in general, including both clinical and public health-related domains.(76)

The definition of "eSurveillance" focuses on surveillance and response.

Given the mandate of the ASIGB, this document will use the term eSurveillance. This document's operational definition of eSurveillance is:

e-Sur•veil•lance: *n* the systematic application of information and communications technology (ICT) across human health, veterinary, and other domains to: 1) improve the timeliness, accuracy, cost, completeness, analyses, and reliability of information

available to public health decision makers and 2) improve the timeliness, effectiveness, cost, analyses, and reliability of systematic responses to health needs of a population.

Additionally, to be complete, any discussion of eSurveillance should consider the eHealth industry as a whole. This documents uses the WHO definition of eHealth (17):

> **eHealth**: *n* the transfer of health resources and health care by electronic means, encompassing ICT in three areas: the delivery of clinical health care, improvement of health services through education, and management of health systems.

The Scope of This Analysis

The focus is on IDSR and IHR support activities, which broadens the scope to eHealth as a whole.

Summary: ***The underlying philosophy of this report is shared with IDSR, IHR, and One Health: three successful frameworks that have added structure, breadth and capability to public health in Africa. In approaching a scope for analysis of eSurveillance, a pattern emerges: eSurveillance blurs the line between clinical and public health approaches. It sits at the top of a pyramid: many other eHealth activities are required to build capacity to support a comprehensive eSurveillance approach. Any organization approaching eSurveillance (especially from an IDSR or One Health perspective) will need a coordinated approach to eHealth as a whole.***

IDSR & IHR frameworks broaden the scope of disease surveillance to include many facets of public health.

eSurveillance refers to a very specific type of activity: the application of ICT to activities of disease surveillance and response. However, through the IDSR framework, disease surveillance since the 1990s has broadened the scope of surveillance activities to include a host of stakeholders and activities. IDSR provides a holistic approach to disease detection, reporting, evaluation, investigation and response (1). IHR, or international reporting and response standards adopted by WHO in 2005, expand many of the same ideas to the international level. Due to the success and wide acceptance of these frameworks (2), any activities in eSurveillance should match their scope and structure. The broad scope of analysis is compatible with this approach.

eSurveillance is not possible without the other fields of eHealth.

While eSurveillance is only part of the field of eHealth, this report will focus on the subject of eHealth as a whole. There are two reasons the scope of eSurveillance activities and analysis must include eHealth as a whole:

1. **On the road toward effectively using ICT and health, "eSurveillance" is at the end, not the beginning: in order to reach disease surveillance, other eHealth projects need to be tackled first.**
2. **The silos in Public Health do not apply to eSurveillance. Inputs into a truly robust eSurveillance system come from across the eHealth spectrum.**

Both of these reasons will be address in turn.

1. "eSurveillance" is an activity at the end of a long road for member states.

Any national eSurveillance system relies on a network of other ICT and infrastructure projects, and to build operational experience and the requisite data for a robust eSurveillance national system, many, many smaller projects naturally come first (83). Each group of projects builds on the next. Specifically, there are five steps in this "eSurveillance pyramid":

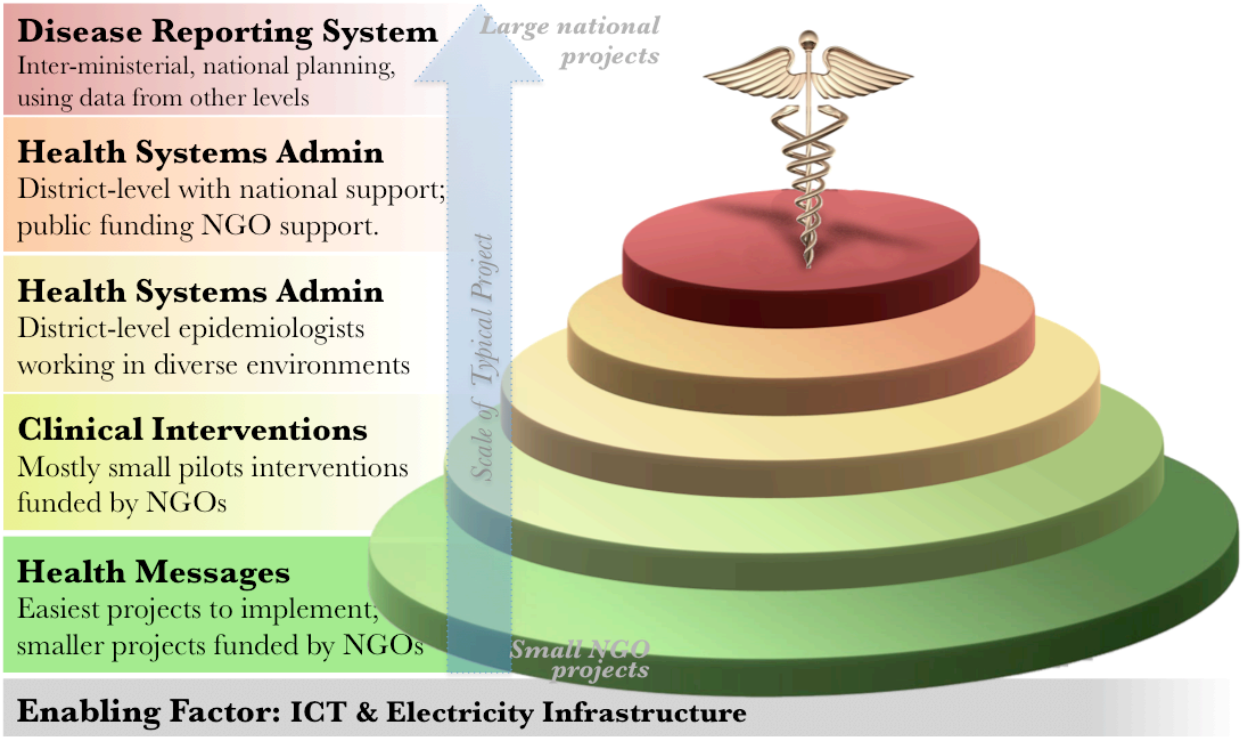

***Figure 1.4**: The eSurveillance implementation pyramid*

- **Enabling Factor: Infrastructure Development**: Before any eHealth project is undertaken, in-country internet & communications infrastructure must be in place; electricity is also required for most types of interventions (83). Private corporations and public utilities (with significant government support) are primarily responsible for this infrastructure. Reliable national ICT and electrical grids are vital to eHealth and eSurveillance.

- **Step 1: Health Communications to Public**: Public education and behavior modification (such as mass SMS campaigns) is the largest category of eHealth interventions. Often the simplest projects to implement, they are possible for NGOs lacking large-scale funding (84). In general, effectiveness is still unproven. These projects provide an opportunity for stakeholders to gain experience in eHealth requirements such as coordinating with

corporate partners (such as telcos (85)) and developing understanding of necessary financing structures. Additionally, these projects fit into the "Community" core functions of IDSR (67).

- **Step 2: Clinical Health Interventions**: Improving quality and coordination of care and addressing health worker shortages are the next largest silo of work in eHealth. Pilots can focus on single clinics, and improving effectiveness of doctors makes for an easy sale to donors. These types of projects (such as OpenMRS) vary in quality and are difficult to scale (86); but they fulfill two purposes for eSurveillance: first, they increase familiarity with ICT across the health system, and, second, information generated by these systems (such as electronic health records) can automatically feed into disease reporting systems (87).

- **Step 3: Health System Administrative Operations**: There are projects that improve management of health clinics and CHWs or assist in the fight against counterfeit medication. They are larger in scale than clinical interventions, but can prove to be useful for mangers even on the district level. These projects can introduce health workers to eHealth concepts, be expanded to provide information on diseases, and, especially in the case of medication, have a higher likelihood of establishing financial sustainability (71).

- **Step 4: Disease Response Team**: A number of systems provide tools to epidemiologists for data collection or interventions such as vaccination campaigns. These teams will be smaller and easier to equip; however, they work in a wide range of environments and technology programs may require national coordination through a ministry of health.

- **Step 5: National Disease Reporting System**: To have a truly, integrated, national surveillance strategy many pieces are needed:

    1. There must be national-scale planning with significant funding (88);
    2. There must be appropriate ICT & electricity infrastructure in place (83);
    3. There must be broad sensitization and experience across the health system, gained from smaller-scale mHealth applications (89); and
    4. There must coordination of many ministries (health, ICT, agriculture, and veterinary sciences) to achieve a One Health-enabled system (56).

  These activities need broad, national coordination and require other areas of eHealth to be in place.

2. Former silos in informatics no longer apply.

As outlined above, eSurveillance will not be the mere transition from paper forms to electronic submissions. A national reporting system will pull information from all other levels of the pyramid (18). For instance, implementing an electronic health record provides an undeniable opportunity to collect data for disease surveillance purposes. Health education systems may have features to collect public health data from the public. Better data on the management of the health system may shed light on data quality issues.

Any national eSurveillance system relies on a network of other ICT and infrastructure projects. Going forward, governments must integrate any effort of disease surveillance within a broader framework to avoid many of the current shortcomings in health systems investment. Well-designed surveillance systems will likely pluck information from clinical eHealth projects (87).

Without the other fields of eHealth, success in eSurveillance is not possible. To reach full effectiveness, eSurveillance systems will feature collection methods will blur the current silos in informatics. See appendix 5 to see the impact of a range of technologies across the IDSR matrix.

To provide a complete view of the environment, this paper will be looking at the eHealth industry a whole, with a special focus on eSurveillance and a One Health perspective.

Details on the Structure of the Industry

The African eHealth market is small (US$382M), but growing fast (12-16% CAGR). Currently, it is dominated by projects implemented by Non-Governmental Organizations (NGOs) and international agencies. Establishing effective eHealth systems is very complex, and experience in the EU shows that countries underestimate the complexity. This reports organizes factors involved in successful eHealth strategies into four domains: People, Process, Planning, and Provision. The full map is presented below:

The eHealth industry as a whole: The market is small (US$382 M), but growing quickly (12-16% CAGR)

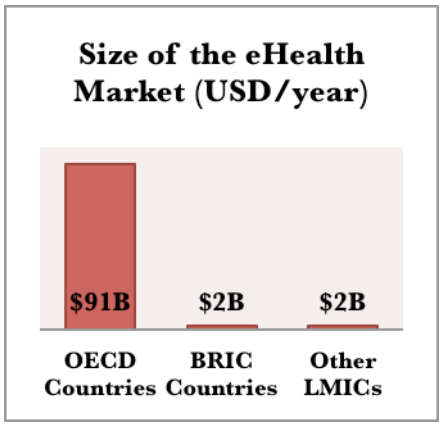

***Figure 1.5**: Size of the eHealth market by national incomes (OECD is Organization of economic development; BRIC is Brazil, Russia, India, China; LMIC is Low-to-Middle Income Countries)*

Few estimates of the total market size of eHealth are publicly available. The Boston Consulting Group reports in 2010 that the yearly market for eHealth was $96 billion, though only 5% of that money spent in the developing world.(8) While concrete figures are not available, it is possible to extrapolate that the eHealth market in Africa is about US$382 million in 2013. Other estimates peg the worldwide market at US$160B.(85)

In the developing world, eHealth accounts for 0.29% of total health expenditures, or USD $1.03 per person. African per capita spending for eHealth is estimate to be USD $0.45. On the other end of the spectrum, developed countries spend between 1% and 2.6% of their overall health budget on ICT (42). In the United States, this translates to USD $127/person, or 417 times the African per capita spending. See Appendix 4 for calculations.

However, growth in the global industry is expected to be tremendous, on the order of 12-16% compounded annual growth rate.(85). Given interest in Africa, the region is likely to see the same amounts of growth.

ICT has an outsized influence on health: a 2011 WHO study found that 25% of health programs in Africa were "ICT enabled." Worldwide, the number of new health programs that featured ICT as a core component jumped by 60% between the early and late 2000s.(9)

The factors that are necessary for eHealth: the 4 P's of eHealth Projects

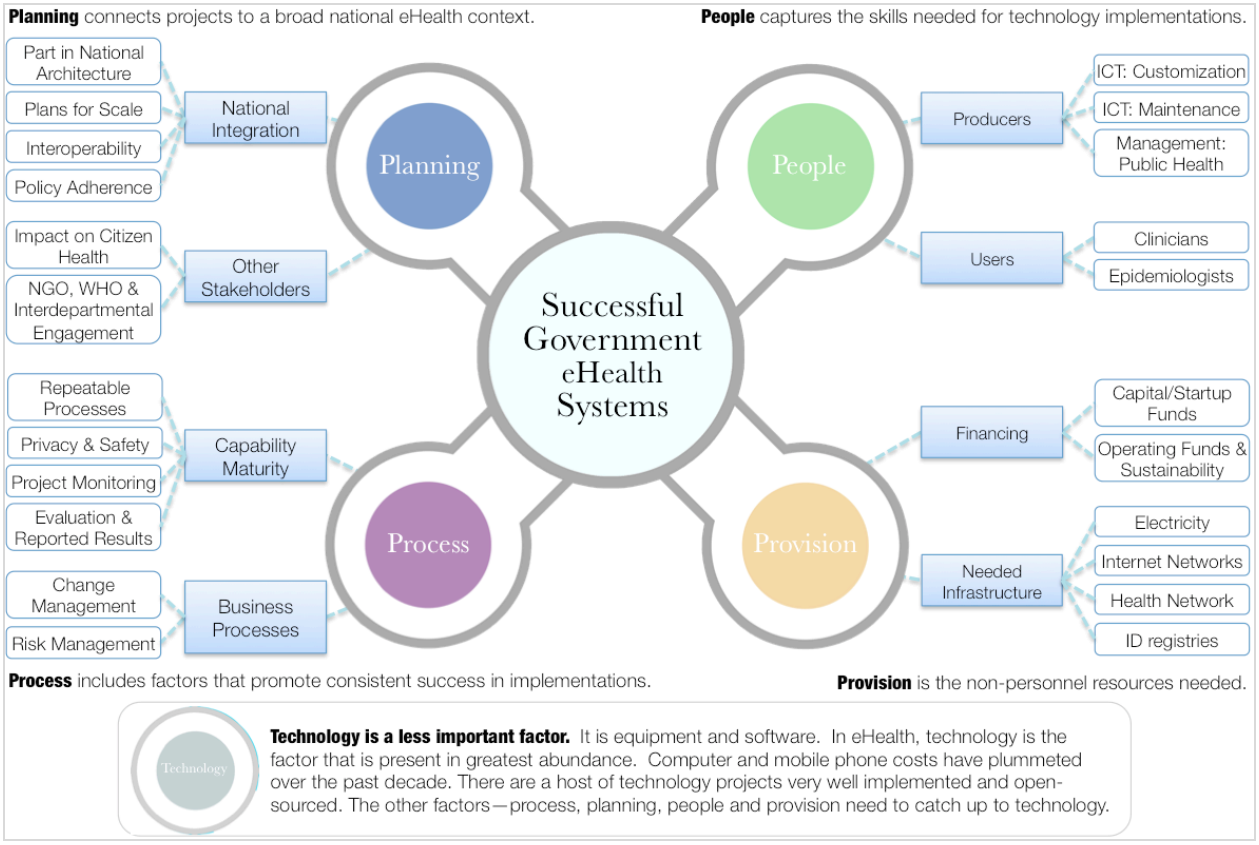

***Figure 1.6**: The 4P Model of Factors of Successful Government eHealth Systems*

Planning:

National Integration: Having a **national eHealth architecture** and corresponding strategic plan is vital to coordinate the wide range of actors in eHealth; important at the national level is comprehensive health policy dialogue to plan the system(15), and a culture of learning that can synthesize results and innovations from the field to improve the systems.(89) **Plans for scale** are important to establish from the beginning of any pilot project, so initial decisions (that may affect cost or infrastructure) do not block later efforts to expand successful results across wider areas (28).

Interoperability (see Terms of Reference) allows different eHealth ICT systems to talk with each other. Governments also need to **establish policies** regulating eHealth, and adherence to policy is important for any individual project(90).

Other Stakeholders: Obviously, the broad aim of any eHealth project is to have a positive **impact on citizen** health; estimating that impact in the planning stages is an important task for project prioritization and later evaluation (48). The eHealth industry also features a range of enabling **NGOs and International Agencies (especially the WHO). Several government ministries** (from the One Health-related ministries of health, zoology and agriculture to ministries of communication or business development) play an important role that should be coordinated (91).

Process:

Capability Maturity: Making **repeatable processes** in eHealth projects allows a country to reduce costs of implementation (92). Keeping focused on **patient safety and citizen privacy** requires standard operating procedures (93). Strong habits of **project monitoring** (having frequent updates of a project as it progresses) are part of having a controlled process for project implementation (92). Finally, **reporting results** (and having a culture that encourages bottom-up innovations that occur in the field to improve the national system) is an important piece of improving the system-wide implementation process (89).

Business Processes: **Change management** (working with clinicians and public health leaders to change their workflows to use the technology provided) is a very important (and often overlooked) part of any eHealth project (6, 94). Promoting local leadership and identifying a "champion" to push the technology is a central component of change management. **Using data to make a decision** (keeping a focus on the end goal for any system, citizen health) is a key habit as well (95). **Risk management**—designing systems to withstand failures of equipment, natural disasters, hackers, or a whole host of other things that can go wrong—often is left undone and not noticed until something catastrophic does go wrong (96).

People:

Producers: **ICT experts**—designers, programmers, testers—are required first to take technology that is already developed and **customize technology** to local contexts(97); then it is required for **technology maintenance**, as nearly

all technical projects need updates as the project moves along .(98, 99). Additionally, **public health leaders** must be well versed in ICT to choose the technology and be able to manage the projects effectively (100).

Users: **Epidemiologists** will be the group using the data, and **clinicians** will oftentimes be the stakeholder entering information with the systems on a day-to-day basis. Ensuring that they familiar enough with technology to use it in their daily tasks can be a challenge. Many projects have failed from lack of user expertise (65).

Provision:

Financing: **Capital/startup funds** are required to buy equipment and technical people to setup the systems (42). However, often overlooked is that all projects will need some sort of **ongoing funding**, whether to pay for program maintenance or for inputs like text messages between project participants (101).

Needed Infrastructure: **Electricity** and **internet networks** are obviously needed for several different types of projects. Likewise, the **health network** (for instance, a network of clinics or community health workers) needs to be in place for eHealth to improve it (102). Finally, bureaucratic pieces, like **national ID registries**, may need to be in place, depending on the project (66).

Section 2: eHealth Industry Trend Analysis

WHY EHEALTH IS GROWING

THERE ARE FOUR DRIVERS OF EHEALTH IN AFRICA.

Summary: eHealth's 12-16% yearly growth is remarkable. eHealth has seen 90% of its projects fail in the past, but it keeps expanding. Identified are four reasons. First, the technology sector as a whole has grown tremendously in Africa, and that industry growth spills over into health. Second, there's a great demand by citizens to improve the healthcare system, but money is short and healthcare workers are few. Technology may maximize efficiency. Third, eHealth in the Global North is nearly a $100 billion dollar industry; easy portability of technology leads to spillover to the Global South. Finally, there is a general faith in technology—people are fascinated and believe it can solve myriad problems.

While the last section covered many of the problems and uncertainties associated with a "bleeding edge" industry, the industry is still growing at a torrid pace: 10-16%. There is a lack of good evidence on how governments make decisions on eHealth(103), but it is held this eHealth growth trend is spurred by four trends:

1. The unprecedented explosion of technology in the Global South

Specifically, there are two areas of drivers to connectivity and technological development:

a. **Mobile Phones Proliferation:** Over 90% of the world's population lives in areas with mobile phone coverage. 7.1 billion cell phones will be activated by 2015. The market was spurred on by deregulation in the late 1990s; between 2008-2010, costs for mobile airtime decreased by 26% (104).

b. **Higher Quality Internet Access:** The first undersea fiber optic cable was laid in 2000; since then, 10 undersea cables have been activated and 4 more are slated for 2014 (105). Since 2008, Africa's Internet capacity has multiplied by a factor of 100 to 34,000 gigabits per second. The cost of the Internet to its service providers has dropped by a factor of 20—from $4,000 to $200 per month for a megabit (44).

Tremendous investments in technology are happening in Africa, and understanding these trends are key to understanding the future of eSurveillance and eHealth.

2. The ongoing health worker shortage

Dating back to the 1960s and 1970s, telemedicine schemes have been seen as a way to maximize doctors' time with patients in far-flung communities and alleviate the often-discussed health worker shortage (13). This discussion continues today, particularly with mobile health and distance learning modules for health workers. As countries grow economically, citizens will demand more healthcare; eHealth may be a way to maximize resources. In Europe, the eHealth IMPACT project has shown a 2:1 ratio between economic benefits and costs of eHealth (106). Such efficiencies are needed in African health systems.

3. Advancement of eHealth in the Global North drives NGO investment

The $94 billion dollar a year investment in eHealth in the Global North is bound to have a spillover effect on the Global South. NGOs especially are driven by donors to apply the efforts being attempted at home to people in need around the world. The eHealth technology in the Global North is not necessarily appropriate for Global South contexts, but it nevertheless promotes interest and awareness in the Global South (69).

4. Faith in technology as a silver bullet

Every era has brought a new effort at implementation of technology to solve the "development problem" (107). People—from the US to Europe to Kenya to South Africa—by in large believe in the future and associate technological advances with advances in quality of living.

Analysis Framework: The Diffusion of Innovation (DOI)

THE DOI MODEL LOOKS AT EHEALTH AS AN IDEA THAT SPREADS FROM ONE GROUP TO ANOTHER.

Summary: The academic researcher Everett Rogers developed a very successful approach to model the spread of ideas to large audiences. Invariably, the idea of "eHealth" as a central tool in public health also will spread in the same way. Rogers' model can be applied both to technology and public policy. It is outlined as a five-stage process, starting with innovators and then early adopters.

"eHealth" is, at its core, an innovative set of ideas—that data and communications technology can be useful in a health context. Starting in the 1960s, the idea of using communications and computers has been discussed within the public health sphere. That idea eventually spread, and now the consensus goal of the WHO dating back to the 2005 resolution on eHealth is to spread these ideas throughout the Global South.

Much organizational research has been completed on the diffusion of new technologies and innovations, dating back to the early twentieth century. In 1962, Everett Rogers developed a very successful model to explain how, why and how fast new technologies spread through a marketplace (19). Rogers' background was in agriculture, but his ideas are applicable to a wide range of areas. (In fact, he opens his book with an example from public health: he explains the failures of an aid worker who was trying to convince families in a Peruvian village to boil water). His framework has been applied successfully to public policy as well (108).

Rogers' model has been expanded with add-on research (20-23). The model as it stands today outlines five stages of innovation:

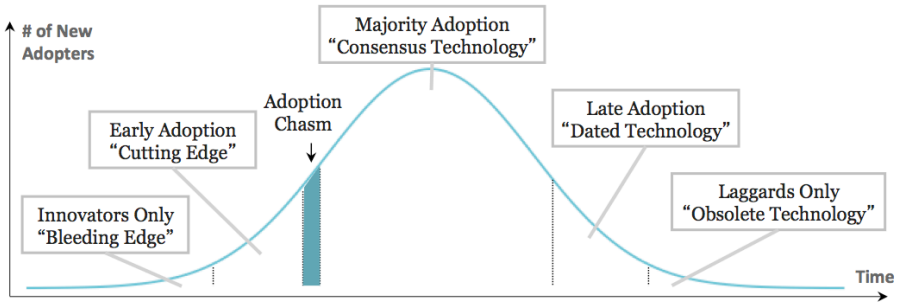

***Figure 2.1**: Number of new adopters for any given time in a typical diffusion of innovation.*

Stage 1: Innovators Only (Bleeding Edge) features technology that has significant potential but has not yet demonstrated value or lead society to come to consensus about its utility. Innovators may win big, or may be unable to recoup large investments.

Stage 2: Early Adoption (Leading Edge) The technology has proven itself in the marketplace but is still new enough that knowledgeable implementers and support personnel are scarce.

Pitfall: The Adoption Chasm: Often, a technology will arrive in the early adoption stage but never move onto broader adoption in the next stage. This is especially the case with disruptive technology.

Stage 3: Majority Adoption (Consensus Technology): Most players agree that a particular technology is the right solution, and the uptake is significant.

Stage 4: Late Adaption (Dated Technology): While the technology is still used and somewhat useful, replacement technology is easily available.

Stage 5: Laggards Only (Obsolete Technology): The technology is no longer implemented by players in the field, though it still needs maintenance.

The DOI model has been extemely successful in explaining the growth of technology, and its details have witnessed several updates and addendums. As explained in the next sections, this model fits eHealth very well.

Furthermore, there are actions that industry participants can take to either impede or speed the uptake of new ideas, which can serve as a set of tools for eHealth coordinating bodies. This is the backbone for the analysis in this report.

TODAY'S EHEALTH INDUSTRY

EHEALTH IS SITTING ON THE BLEEDING EDGE.

Summary: Applying the DOI model makes it is clear that eHealth industry is in the bleeding edge phase of adoption of innovation. Each of the 4Ps (Planning, People, Processes & Provision) demonstrates classic bleeding edge characteristics. In Planning, the field has been filled with small pilots that show promise, but are run by NGOs and never scale to a level where they can be part of a national strategy. In People, there is a lack of awareness & expertise to implement eHealth projects. In Process, there is a similar lack of evidence on what works and what does not, so impact assessment and data-driven decision-making is difficult to accomplish in the field. In Provision, successful financial models in the industry are rare.

bleed•ing edge: n A stage characterized by a loci of technology that has significant potential but has not yet demonstrated value or led society to come to consensus about its utility. Innovators may win big, or may be unable to recoup large investments.

eHealth is in a bleeding edge stage—it is a new industry based on new technology, but the potential has not been demonstrated conclusively (19). eHealth has many proponents, especially at the WHO and in NGOs, but overall spending in Africa is still low at USD $0.45 per capita (see discussion section 1 above). The industry is disordered, with many diverse players in uncoordinated roles.

In other words, this is the "Wild West" stage of development (to use an American phrase referring to settlement in the 1800s of the western part of the US). eHealth is in a period of exploration of a new frontier previously unknown to most, featuring many independent actors who are by-in-large disorganized and ungoverned by the state.

The full list of problems in eHealth associated with disorganization is long and well laid out in other publications. In fact, a well put-together report by AFRO(109) lists the basic industry inefficiencies. However, the report of the problems that come up in a discussion on eHealth—the lack of evidence, standards, etc.—applies to bleeding edge industries. This section touches on these, but this more general report, by and large, instead focuses on strategies to develop and coordinate eHealth and eSurveillance capacity across Africa.

What specific eHealth industry characteristics signify it is in the bleeding edge stage? There are seven across the 4Ps:

1. Planning

A. In eHealth, "Pilot-itis" abounds: projects are small scale and unsustained.

The eHealth industry has an affliction called "Pilot-itis". It is often a fragmented marketplace with a myriad efforts run by many players. In this environment, there are hundreds of pilot projects (the World Bank counted 500 in 2012 (16). The GSM Association lists 330 in Africa (68). There are other lists of ongoing projects from at least nine other organizations, with significant lack of overlap between them[1], the vast majority failing to scale up to serve a larger population.(14) The ITU estimates that since the 1960s, well over 90% of all telehealth projects have failed.(10)—45% after 1 year, and another 45% after 3 years.

In fact, in 2008 the ITU identified a cycle of eHealth pilots:(10)

1. An NGO, entrepreneur or health researcher designs an intervention, finds funding for one to three years, and identifies a village;
2. Enthusiasm and partner-gathering lasts for 6 months, after which the difficulties of daily maintenance of technical systems set in, as well as the difficulties of working with over-burdened health professionals in rural clinics.
3. After two years, the program has produced positive results, but not so positive as to warrant continuing of the project through community or other funding. In the end, the health status of the village is unchanged.
4. A paper and end report is published, and the researcher moves on to a new project.

This small scale means there's no coordination. Governments often don't have national strategies or national policies. Programs don't talk to each other (110). eHealth is largely run by NGOs, often without government coordination of efforts. In the last published WHO survey in 2010, only 12% of governments in Africa said they had a completed "eHealth" national strategy(111).

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1 MobileHealthInfo, Health Market Innovations, Health Unbound Database, Johns Hopkins Global mHealth Initiative,

B. The eHealth industry is driven by suppliers, not demanders

As very clearly defined in ITU's Project Lifecycle above, it is typically the health researcher or the NGO that studies a problem and develops an eHealth project; traditionally, it has not the government or community requesting the technology. In some documented cases, NGOs will demand a certain technology be used. The impulse is good—to help people or build a sustainable business—but the results miss the market: This system wastes efforts, as the suppliers may be unaware of hard-to-see factors in local communities (16).

2. People

A. Pilot designers and scale-up champions typically will come from different professional worlds.

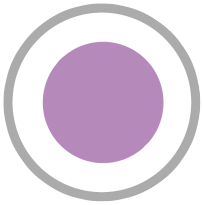
As outlined above, NGOs or academic researchers typically take an entrepreneurial role: they identify the project and design a pilot to meet that need. Typically, these projects are run by entrepreneurs or technologists. However, the people making the decisions come scale-up time—leaders in the ministry of health—are medically trained. This gulf in communications and outlook can have a negative impact on successful scale-up strategies (16). In fact, this gulf between public health and technology can be seen as a root cause of the eHealth industry's fragmentation.

B. Expertise & awareness to implement eHealth is lacking.

Too few experts are available for implementation. For instance, as of 2012, Ethiopia had one ICT person responsible for oversight of all Ministry of Health ICT projects on the national level. Uganda also faces a shortage of qualified ICT personnel (32). The total number needed, however, is unknown (37). This lack of experts to lead the effort is a clear sign of a bleeding edge technology, as outlined by Rogers. In the developing world, implementations of national systems of populations over 5 million are very protracted and complicated (112). It is impossible to implement a nationwide system with few ICT staff. While there are many software packages available for use, adopting technology to local contexts is the difficult part (6, 94).

Understanding across the healthcare system of eHealth is obviously paramount—people cannot adopt what they do not understand. While no industry-wide study is known, smaller studies across from Ethiopia revealed less than half of healthcare workers understood the possibility of using ICT in their medical work (34). Similar results have been found in Nigeria (35).

3. Process

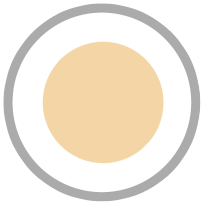


Evidence for successful interventions is lacking.

There is a paucity of hard evidence on the efficacy of eHealth interventions. A comprehensive 2010 review of 2,043 citations on eHealth found only 32 controlled studies (40).

In eSurveillance, there are studies showing projects resulting in improved accuracy and timeliness, plus reduced costs and human resource overhead for adapting surveys (48). However, there is a gap in the literature in testing impacts on utilization of the data (87).

4. Provision



A. Successful financial models are very rare.

Applications of eHealth achieving financial viability on scale are scarce (71), which results in disruptive funding (27). A survey by the Center for Health Market Innovation found that 47% of all projects using technology in the developing world were primarily funded by donors (9). The dream of any public health project is to be self-financing, of course, but given the huge inputs of capital needed to augment already strained public health financing systems, there is agreement that having better funding mechanisms is needed to move the industry forward (71).

B. eHealth requires capital investment, while most of health systems spending is on operating costs.

eHealth dollars can go a long way—with only 0.3% of total health spending spent on eHealth in Africa, 25% of health projects reported in 2011 that they used some component of eHealth. But it is a different type of spending.

Health systems spending is mainly focused on spending on operations: doctors, nurses, medicine, surgical supplies, CHWs and the other vital healthcare pieces are extremely expensive to hire, procure or retain. While facilities are important, the construction of a clinic may cost less than two years of staffing that same clinic. On the other hand, eHealth, while cheaper in the long run, requires an intensive upfront expenditure. The credit needed may not be available to the districts or states, or managers may not be comfortable with this type of investment (42). eHealth projects may also not be designed to reduce staffing costs: generally, they expand access to underserved populations rather than reducing the costs of serving the same population.

Leaders in eHealth have been challenged since the industry's inception. Money is thin, technology applied has been designed for use in wealthy countries, and those in charge of the system—those with medical training—can be unaware

of technology's use (16). However, the industry is progressing. Signs of the progress are presented in the next section.

The Short-term Future: Tomorrow's eHealth Industry

eHealth moves from bleeding to leading edge.

Summary: While currently eHealth is in the Bleeding Edge stage, over the next few years, it will move to the "Early Adopter" stage or the "Leading Edge." The 4P model applies here as well: in Planning, the industry in Africa is seeing more national consolidation and international coordination. For People, the ICT industry as a whole is changing rapidly, and this increase human capital has tremendous effect on health ICT. In Process, more high-quality evidence is coming out. For Provision, new models of financial sustainability are being explored in some areas of eHealth.

> **lead•ing edge**: n A stage characterized by proven itself in the marketplace but is still new enough that knowledgeable implementers and support personnel are scarce.

The problems of the Bleeding Edge are well recognized by many experts in the eHealth industry, and a number of responses are becoming clear. Discussions of “Pilot-itis” have dominated conferences. Reactions by official bodies also are coming into view.

Specifically, there are five trends that indicate the industry is moving into the “Early Adopter” Phase over the next two years:

1. Planning

A. National consolidation of eHealth is starting.

A clear example of a country with the "Pilot-itis" epidemic is Uganda. In that highly connected country, a full 23 of 28 projects surveyed that started in 2008 as a pilot had not progressed past the pilot stage by the end of 2009 (86). As Figure 2.2 shows, UNICEF listed 37 pilots in the country in 2010. This number is not inclusive of all projects: the GSM project lists a full 48, without much overlap with the UNICEF census (68).

The response is also clear in Uganda: a national moratorium on new mHealth projects was established in April of 2012. Soon after, UNICEF sponsored the hiring of an expert national coordination of mHealth. (29, 113)

In fact, this trend is observable across the continent. In 2005, the WHO has prompted all governments to adopt eHealth strategies (76). In 2010, South Africa put in place a moratorium and soon after a new national eHealth strategy (114, 115). Kenya completed its strategy in 2008

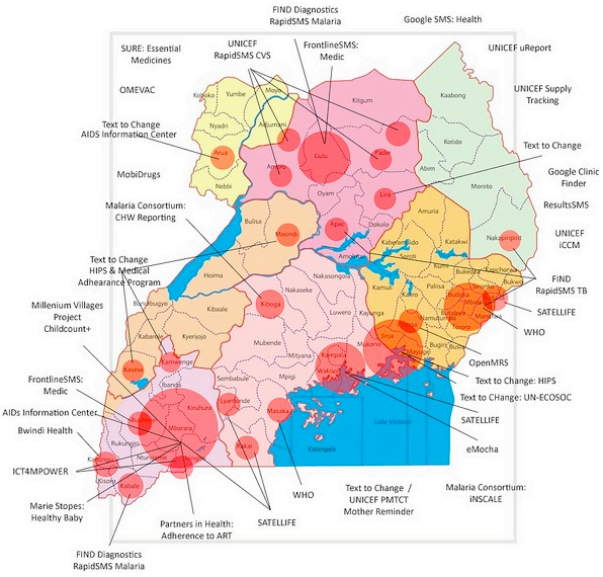


***Figure 2.2**: Selected list of mobile health projects in Uganda (Credit: Sean Sean Blaschke/UNICEF, 2010)*

Scaled systems are few, though they do exist in all AFRO geographic areas. Rwanda, Zambia, Malawi and Nigeria all have health systems that function on a national level. Use of data to inform public health decisions has also increased since 2005, prompting better outcomes and putting pressure on better data use (95).

B. International coordination has increased, especially in eSurveillance.

An important effort, CORDS (Connecting Organizations for Regional Disease Surveillance) (116, 117) is a promising network venture funded by NTI, the Rockefeller Foundation among others. It represents sub-regional networks—notably in South Africa (SACIDS) and East Africa (EAIDSNet), and most successfully in the Mekong Delta Region. These organizations are built to: 1) encourage accountability through IHR & PVS (Performance of Veterinary Services); 2) improve use of One Health Frameworks; 3) spur technology innovation(118); 4) improve networking among regional players.

2. People

The capacity of the ICT industry is growing.

Africa is seeing a significant growth in its ICT industry and culture of ICT entrepreneurship. Currently, ICT accounts for 7% of African GDP; in fact, the increase in African economic growth of the 2000s can be attributed to increased investment in telecommunications companies (84). The ICT entrepreneurial environment in Nigeria and Kenya have been rated by an IBM report as better than any in Europe, and Ghana is close behind (119).

This is nowhere more visible than Nairobi, where start-up incubator iHub is finding success. iHub represents a class of small organizations that provide working space and networking opportunities for anyone in the ICT field. The term "Silicon Savannah" has been applied repeatedly to Nairobi and has been encouraged by a purposed US$7 billion government investment in a 5,000 acre city campus as a home for the ICT industry (120). Hype may outpace reality in areas called the "Silicon <Insert Geographical Feature here>", failures of the ICT system in the most recent Kenyan election underscore the tenuous nature of Africa's assent (121). However, there seems to be serious government backing and significantly more activity in the tech start-up space.

More training is available for ICT in health, though not enough: there are only 15 formal programs offered by 13 institutions (122).

3. Process

More RCT trials are being conducted & more articles on standards are being produced.

There has been a substantial uptick since 2011 in number of RCTs. A study in November, 2012 found that there were 215 randomized controlled trials underway that mention mobile health, with 40 having been added since May of that year (14). The past 6 years has also quadrupled the number of articles about standards (55).

4. Provision

Funding sources are becoming more mature.

Along with evidence and private industry support, there is more talk of financial viability, especially integration with the for-profit telecom industry (85). There are several examples of public private partnerships in this area (123). Advancements in the African ICT field have led to the formation of several venture capital funds, such as Savannah Fund or VC4Africa (44).

A February 2013 report from the mHealth Alliance & Vital Wave outlined a framework, including an example in Switchboard, a West African service to connect health workers by mobile phone, subsidized by charging users for non-work related calls. Additionally, a company named Sproxil has raised several million USD in capital to provide drug verification services. However, large scale, systematic examples of financing, however, remain undeveloped (71).

Finally, there is more large-scale investment from non-traditional national government agencies that are nonetheless focused on technology: specifically, DTRA and the European Space Agency are making significant eHealth investments. These nontraditional funders bring new, previously untested models. DTRA, for instance, is pursuing ideas like "competitive prototyping" or "x-prizes" (or running public competition that pay out to the group that creates a product that preforms certain tasks best or to a minimum standard) (124).

The future: Further eHealth expansion will gravitate to where industry constraints disappear.

While it is a cliché to say that technology changes quickly, the truth is undeniable. The past ten years have brought Facebook, Twitter, iPhones; the past 20 have brought nearly the entire phenomenon of the internet. eHealth may change overnight. That quickened pace of change will come in areas where constraints disappear. If computer equipment becomes cheaper, we may see more tablet computers in the field. If solar power is less expensive, desktop computers may be installed quickly into rural villages. If new waves of private capital are available, private enterprise in eHealth may take off (16). The "next big thing" is very difficult to guess.

The Leading Edge phase is progress, but eHealth will soon face the “Adoption Chasm.”

The future seems quite bright, though the stark truth is, at this point, much of the promise may turn out to be simply hype (14). Business and health impact models are too underdeveloped to truly lower costs and make a demonstrable impact in health outcomes across the African health system. In 2012, investments into eHealth were described by the World Bank (one of the largest funders of eHealth in Africa) as "best-guess predictions" and "leaps of faith."(16)

The potential of technology is strong enough to justify that faith for now. But the Diffusion of Innovation model suggests there is the possibility of an “Adoption Chasm” coming (24)—the spread of eHealth to member states in Africa may severely drop off. The next section will cover the Adoption Chasm in greater depth.

INDUSTRY RISKS: A "GOLD RUSH"

THE INDUSTRY IS APPROACHING THE ADOPTION CHASM.

Summary: ***The widespread use of ICT in health will happen eventually, but full use may take decades longer than expected. The history of the eHealth industry is filled with failures—over 90% of projects, according to the ITU, have failed. To this point, there has been a Gold Rush in eHealth—investment by a lot of parties without much to show for it.***

The Diffusion of Innovation model suggests there is a chasm coming. If the potential of eHealth is not proven to countries that are deciding on adoption, investments will be delayed, possibly by decades. The future will bring further fragmentation and slowed innovation. eSurveillance, as it builds on other disciplines, is the most likely victim of this chasm. Ultimately, a future of eHealth falling into a chasm is a future with more emergent diseases.

Alternatively, however, there is another possibility: more countries may adopt eHealth. New tools and frameworks will emerge and costs will decrease. The gap in the industry to arrive at this future is a strong intergovernmental network.

An example of The Chasm: The Apple Newton

The year 1993 brought a wonderful product named "Newton" made by Apple. It was revolutionary—it was the first portable digital assistant. Users could use it as a calendar, an address book, a word processor, a spreadsheet, and an electronic book reader. It had handwriting recognition and third party applications. Apple put $100 million into its development; It was supposed to change the world (125).

The Newton fell on its face. Tech enthusiasts loved it, but the mainstream stayed away. It almost bankrupted the company. PDAs were set back years—Palm Pilots were a very scaled back version of the Newton. it really wasn't until Apple tried again in 2007 (this time adding a phone feature) that the world could buy the same features in a hand-held device. (126)

The Newton fell into what is called the Adoption Chasm. eHealth may face the same challenges but on a much larger scale.

Figure 2.3*: The Apple Newton*

It is clear that the eHealth industry is moving from the “Bleeding Edge” stage to the “Leading Edge” stage. A marked move towards national consolidation is evident, ICT capacity is improving, and the results of fragmentation—evidence and standardization—are being better addressed. However, in process of diffusion of innovation, a danger to future

adoption lurks: there is a “chasm” between innovators and early adopters (those visionaries who have a faith in technology) and mainstream adopters (the pragmatists who may be skeptical) (24).

eHealth may be facing an investment bubble from a "Gold Rush" mentality.

To extend the Wild West metaphor, eHealth may in a "Gold Rush", where speculators learn there is money to be made and rush into the industry. Such an environment may attract well-meaning people who are not interested in putting in the years or decades it takes to launch successful projects. The result is a universe of single purpose applications that can't talk to each other and can't sustain themselves (55). Worse, in this environment of hype, illegitimate actors could offer technological solutions that don't work. If this activity has inflated the estimation of eHealth's potential, the bubble may burst and eHealth investors may be hesitant to continue investment **(16).**

We have seen cycles of “false dawns” before in development efforts, especially in telemedicine: the field saw great enthusiasm and many pilots in the 1960s and 1970s, the majority of which ended in failure. The resulting psychological turnoff to telemedicine left the 1980s with very few projects (65). The modern industry is strewn with failed pilots—the ITU estimates (very conservatively) that 90% of pilots have failed; the number of failures is likely well over 1,000 projects (10). As projects become larger, future failures may generate large amounts of attention in the public sphere, setting back the field.

eHealth diffusion isn’t guaranteed if risks for countries are too high.

In the Global North (which is further along the diffusion cycle), a significant number of clinicians fail to see added value in eHealth systems (127). eHealth systems are difficult to implement:

- In the United States, 25 years after computers became ubiquitous in business, 46% of doctors do not use an electronic medical record system (128).
- The EU has also seen nation-wide projects fail. A report by the European Commission notes the number of national EMR systems that have failed: "more than around 10m inhabitants tend to fail to implement nation-wide applications." (15)
- In 2011, national auditors from the UK presented a scathing view of their national eHealth system: "The original vision for the National Programme for IT in the NHS [National Health System] will not be realised... This is yet another example of a department fundamentally underestimating the scale and complexity of a major IT-

enabled change programme…. I hope that my report today… will help to prevent further loss of public value from future expenditure on the Programme" (129).

- Successful systems take many years to implement. In Andalusia, Spain the DIRAYA started in 1999 and, as of 2011, while showing positive results, had yet to be fully completed (15).

While the huge investments in eHealth in the Global North guarantees continued adoption, poorer countries in the Global South, with investment at only 0.29% of total health budgets, may be slower to adopt. Risky technology is a hard sell in countries with crumbling health systems. As eSurveillance is at the top of the previously mentioned “eHealth Pyramid”: the many health systems needed to for eSurveillance to meet its potential will be missing.

While eHealth will not stop among adopters, an the eHealth chasm is a world with the following:

1. **Fragmentation will increase**: A divide may widen between the “haves” of eHealth and the “have-nots”, as poor countries decide that eHealth does not represent the safest investment for their limited resources.
2. **Messy hybrids between paper and electronic systems could be the norm**: As US residents can attest, having a system with some paper and some eHealth facilities in place can create more confusing and less positive health outcomes. eHealth may move forward, but even within a country, the implementation may be uneven. If there's no faith in eSurveillance, actors in the field may create their own "shadow systems" that work around the technology through informal means (95).
3. **Innovation will slow, and interventions will be more expensive**: If a significant backlash develops, the entrepreneurial ICT network growing in Africa may not focus on health, and healthcare innovation lag behind the Global North for another generation (16). Major initiatives in public health cannot rely on a solid ICT backbone. No standards will be in place, further increasing costs for implementations (130).
4. **eSurveillance will suffer the most from the chasm**: While clinical mHealth funding is the leading category of nonprofit spending, governments are much more likely to be supporting eSurveillance (16). This follows from the natures of public health versus clinical health. Clinical Interventions can take place on a smaller scale, and the results (as in helping children) can be made into stronger emotional appeals. On the public health side, the result of any surveillance efforts are spread across a population, the investments required for are much larger,

and governments (or large institutional funders) would be more likely to be central drivers of any surveillance effort. (88)

5. **Emergent diseases will be more likely**: Most concerning, emergent diseases may develop undetected and affect the entire continent if surveillance systems are not improved and integrated (56).

If the field is slowed by a lack of adoption, it will not be the smaller pilots that suffer—it will be the larger systems that are vital to eSurveillance capacity.

The brighter alternative future is majority adoption.

If the industry can cross the adaption chasm, Roger's model says the Majority Adoption stage will bring many new benefits:

New tools to fully support operations of IDSR systems in larger, nationally consolidated eSurveillance systems: Technology can be a boon to IDSR. Getting countries to invest is the first step. See the next section for a discussion of the potential of IDSR & eSurveillance.

1. **Costs for organizations will plummet, leading to widespread adoption even by smaller countries**: First, risk sharing strategies will allow for smart investments by smaller countries. Small scale will no loner be a prohibitive factor in eHealth implementations if countries can work together.

   Secondly, a tipping point will arrive for technology standards: As more countries roll out systems, eventually, they'll start copying each other. This leads to de facto standards, which then can be institutionalized (22). Better standards mean less costly implementations (131).

   Finally, some organization will create maintain of an all-encompassing eHealth repository, reducing costs and improving standardization. Today's industry features several "resource library" organizations, but none are fully maintained or nearly comprehensive. At some point, a player will consolidate knowledge about eHealth into one location, reducing costs.

2. **Unthought-of technology will emerge**: If an entrepreneurial environment is established, things that haven't been thought of yet will soon become possible.

Networking is needed to spur adoption and bridge the chasm.

There are several gaps in the eHealth ecosystem, but the more countries are able to adopt, the higher likelihood of success and innovation in the industry.

There are several actions a coordinating body can take to help the industry avoid the chasm. These are outlined in Appendix 6. However, the greatest need in the industry is for a strong networking organization—a body that can bring all participants together to build trust, work on problems together and learn from one another. Section 5 goes into greater detail about this.

Section 3: eHealth Industry Trend Analysis

Profile of Government eHealth Investments

Only 6 governments have up-to-date eHealth strateiges.

Summary: According to the WHO, only six governments in the WHO/AFRO region have complete and up-to-date eHealth national strategies. However, every country in Africa has some type of eHealth intervention. Fewer have eSurveillance projects. Additionally, two trends in regulation are clear: first, governments are putting moratoriums on eHealth pilots so the national government can review their place in a national strategy. Second, governments are increasing investment into the ICT industry, in hopes of incubating a new Silicon Valley.

By the numbers: Few countries have strategies or national surveillance systems, but each has at least some eHealth.

Countries with any complete national eHealth strategy	11 countries (24%) (25, 26)
Countries with national eHealth strategies that are up to date	6 (13%) (25, 26)
Countries with eHealth implementations	46 (100%) (132)
Countries with mHealth eSurveillance implementations*	16 (34%) (133) In Pilot Phase: 8 (17%) In Established Phase: 8 (17%)

The global average is 26% (133); Africa has the highest utilization of any region of mHealth for eSurveillance

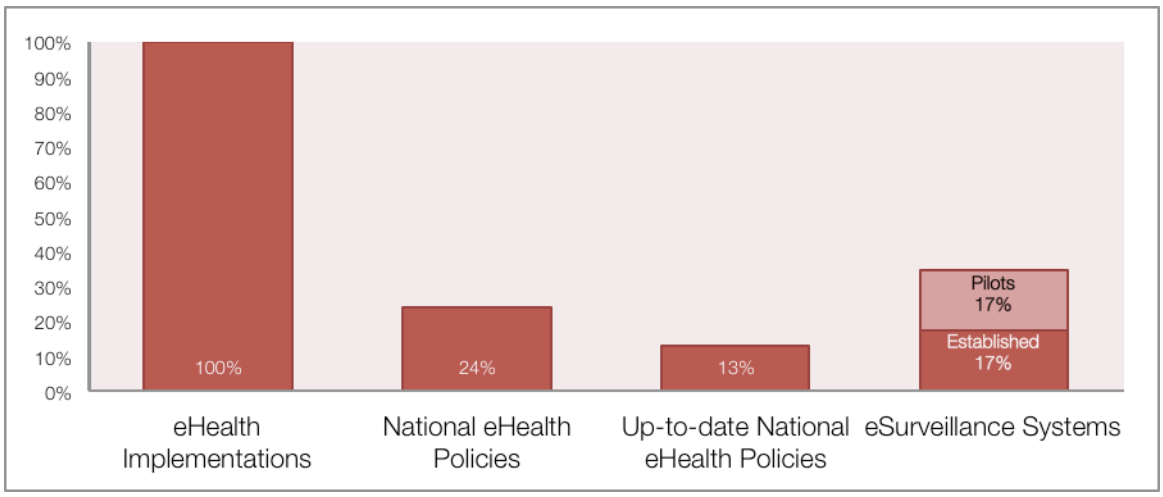


Figure 3.1: *Percent of African countries with eHealth Activity*

eHealth Funding: In 2010, only 22% of all WHO-surveyed eHealth programs were funded by government; 47% of programs were funded by of donors and 25% were funded by out-of-pocket payments (9).

Examples of major systems & regulations

Trends in regulation:

- **eHealth Moratoriums**: Both South Africa and Uganda have put into place moratoriums—any organization that is looking to implement an eHealth intervention must register and be approved by government. While this has slowed expansion of eHealth organizations, it has also established more government consolidation of eHealth (29).

- **Major National ICT Investments**: The flashiest ICT investments are in Kenya, where the government is planning a US$7 billion government investment in a 5,000 acre city campus as a home for the ICT industry near Nairobi (120). Rwanda has a 20 year phased plan to build an enabling environment and the foundations of a knowledge economy (134).

Examples of national systems: Most well-established eSurveillance systems are in Kenya, Nigeria, Tanzania, Uganda, Rwanda, and South Africa. Examples include (5):

- mTrac: mTRAC allows health facility workers in Uganda to send government reports by SMS, including real-time data to map facility stocks.
- TRACnet: TRACnet is a comprehensive data entry, storage, access, and sharing system created in Rwanda in 2005 by the Treatment and Research AIDS Center.
- ChildCount+: ChildCount+ uses SMS text messages to facilitate and coordinate the activities of community based health care providers, usually community health care workers (CHWs). Using any standard phone, CHWs are able to use text messages to register patients and report their health status to a central web dashboard that provides a real-time view of the health of a community.
- e-IDSR: To Implement IDSR, Tanzania developed a suite of tools created under the e-IDSR umbrella.
- Use of EpiSurveyor in Senegal(133): The government in Senegal used a free, open-source data collection tool for mobile devices called EpiSurveyor to collect maternal health data across ten districts.

THE BIGGEST RISKS IN eSURVEILLANCE INVESTMENT

USING MEMBER STATES' PERSPECTIVE FOCUSES THE DISCUSSION ON THREE LEVELS.

***Summary:** With the severe financial and organizational challenges associated with national health systems in Africa, asking countries to invest in eHealth is asking them to take on tremendous risk. Outlining risks from a government perspective can provide a view of gaps in the industry. Eight risks are found stemming from a lack of expert personnel, research, and money, as well as risks stemming from the uncertainty of innovation in untested fields.*

Outlining the risks that member states are faced can provide a map of the problems that the ASIGB will set out to solve.

It is clear that eHealth will only succeed in Africa when national governments take the lead and national strategies are in place. There is need to support governments in this endeavor.

With overwhelming health problems, shortages of people, pharmaceuticals and political capital, asking countries to invest in as-of-yet-unproven systems is asking them to take on tremendous risks. eHealth is not simple, and the future state is unclear. Yet risk management is a topic of the literature that receives little attention.(103) As part of the environmental scan, this report ranks the risks as they are presented.

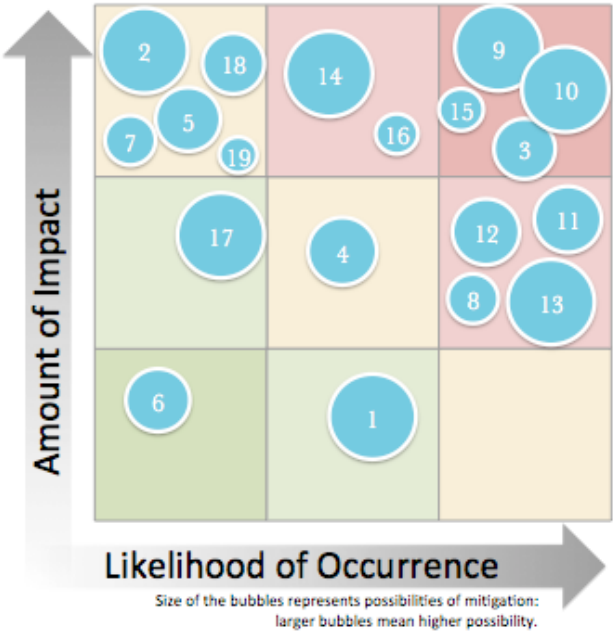


***Figure 3.2**: Risk analysis chart, mapping impact and probability of occurrence. The numbers correspond to risks outlined at the end of this section.*

The risks, collected in research of published literature (46, 90) and gray literature were listed and rated, according to four factors, based on a qualitative review of the literature:

1. Likelihood of occurrence
2. Severity of impact should the risk be realized
3. Ability for an international body to help mitigate the risk,
4. Interaction between risks.

Peer reviewed articles and gray literature were inspected to gather evidence to determine an approximation of the intensity of each factor above. See Appendix 6 for a full account.

There are eight significant risks identified.

The most significant risks are among the **People**. The biggest risks are in human capacity: without knowing the corps of computer programmers, (**Technical Human Capacity Risk**) system development is much more expensive and less reliable while governments will lack as much control. On the flip side, public health departments is lack a familiarity with informatics (**Public Health Management Capacity Risks**), it is difficult to select systems, outline specifications and oversee implementation. Countries may have a difficult time judging their capacities on these fronts.

The next class on the Individual Project Level is in Provision: Having uncertain funding sources may make meeting outlined needs difficult (**Funding Risk**) . Likewise, not only may money be tight, but there may be significant uncertainty in how much the systems will cost to implement (**Overspending Risk**). Finally, on the processes needed, any technical the system may function but the need for change management is misunderstood—it is possible that health workers will resist utilization of new processes (**Adaption Risk**).

On the National Strategy Level, there are fewer risks; while there are risks associated with policy, internal political pressure and managing NGOs, the most significant risk comes from the possibility that a country may choose the wrong eHealth projects to pursue in its eHealth portfolio, and health outcomes may not improve. (**Impact Risk**). Additionally, there is a large, complex investment in eSurveillance: national systems may require massive amounts of funding Next, from a Process standpoint, include many interlocking systems and be highly interdependent, meaning one failure cascades to the rest of the system. (**Complexity Risk**)

In national integration, the most pressing risk comes from moving too fast (**First Mover Risk**): an early adopting country may miss out on the experience gained from other countries who move first. Other countries working first will pave the way for easier implementation later, so there is a strong incentive to wait to implement an eSurveillance system. This is a major threat to the success of the eHealth industry as a whole.

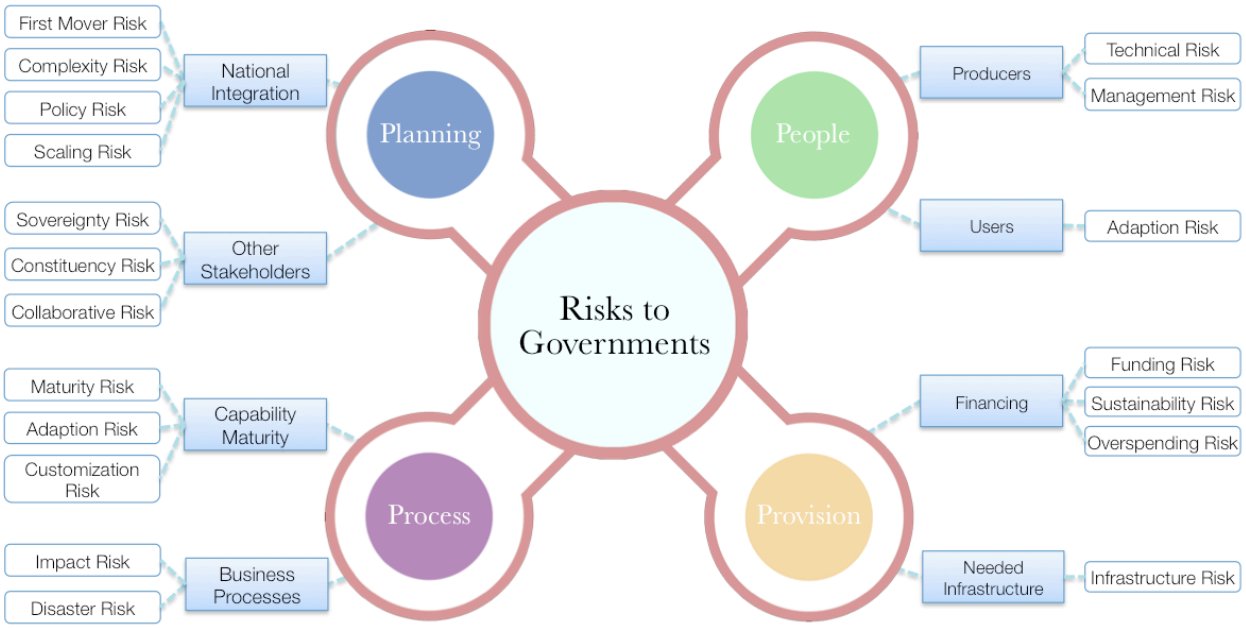


***Figure 3.3**: Map of government risks in eHealth activities*

The tables below outline the likelihood, impact and mitigation of each risk, according to a level of high, medium and low. Each level received a number (High: 3; Medium: 2; Low:1), and the values from the three grades were multiplied. It is assumed that the risks that can be most effectively addressed should receive higher priority. Therefore the highest risk with the largest chance for mitigation are receive the highest scores.

Planning Risks

	Risk	Likelihood	Impact	Mitigation	Score
1	**First Mover Risk: Other countries working first will pave the way for easier implementation later**	High	High	Medium	18
2	Sovereignty Risk: International body may set internal policies	Low	High	High	9
3	Complexity Risk: Complex system working together	Medium	Medium	Medium	8
4	Policy Risk: Policy development may be costly	Low	High	Medium	6
5	Scaling Risk: Projects may not be able to grow in Phase 2, Phase 3, etc	Low	High	Medium	6
6	Standards Risk: Standards adopted may not be	Medium	Low	High	6

	international standards				
7	Constituency Risk: Stakeholders in the country will rebuke the decision to invest in eHealth/eSurveillance	Low	High	Medium	6
8	Collaborative Risk: Drive away NGOs or with heavy-handedness	Low	Medium	Medium	4

Process Risks

	Risk	Likelihood	Impact	Mitigation	Score
9	Maturity Risk: Health systems may not have strong management habits and able to accomplish the goals set by leaders	High	High	High	27
10	Adoption Risk: Health won't agree to system	High	High	High	27
11	Impact Risks: The investments chosen may not result in a measurable difference to health system outcomes	High	Medium	Medium	12
12	Disaster Risk: Projects may not be prepared to deal with contingencies	Low	High	High	9
13	Customization Risk: Technology may not fit local needs	Low	High	Low	3

People Risks

	Risk	Likelihood	Impact	Mitigation	Score
14	Technical Risks: Don't have the talent in place to implement & run system	High	High	High	27
15	Management Risks: Don't have the talent in place to select system & oversee implementation	High	High	High	27

Provision Risks

	Risk	Likelihood	Impact	Mitigation	Score
16	Funding Risk: Money may not be available to meet the necessary budget	High	Medium	High	18
17	Overspending Risks: There may be budget overruns	Medium	High	High	18
18	Infrastructure Risk: Electrical and communication network may be unreliable	High	High	Low	9
19	Sustainability Risk: Projects may be expensive or difficult to maintain	Medium	High	Low	6

Section 4: Industry Gap Analysis

Bridging The Chasm: Enabling Organizations

Understanding the universe of organizations that help implementers sheds light on gaps in the industry.

Summary: ***There are two domains of organizations working in eHealth in Africa: implementing organizations that run eHealth projects and enabling organizations that help implementing organizations do their work. Given the current mission for the ASIGB to assist governments, interest is on enabling organizations. To provide a comparison of the field, a Weighted Measure of Reach was calculated for 71 identified enabling organizations. Those enabling organizations were broken up by domain of work (funding, research, ICT training, etc.). This exercise reveals three insights: that the most active area is funding, that technology is well-provided for by enabling organizations, and that networking organizations are becoming more common.***

In some sense eHealth is an entrepreneur's dream with no dominating players and freedom to experiment. Africa has hundreds of organizations working away on what they hope will be the next Twitter for community health workers or the next Facebook for clinicians. Most will not be successful, but understanding this space is crucial to understanding the eHealth industry. Understanding the gaps in coverage is crucial to addressing the eHealth chasm.

Section Summary: Analysis shows five holes not well addressed in the industry.

Governments are becoming more central, but NGOs, foreign aid departments from Europe and North America, international agencies, private organization all play an important part in supporting eHealth. Two over-arching domains can be identified for eHealth organizations in Africa—**implementing organizations** that run eHealth projects (including larger NGOs and government ministries) and **enabling organizations** that provide a service to the implementing organizations. Our interest is in the enabling organizations, as the role of the ASIGB is not to implement projects, but to improve the efforts of implementers in member states.

The analysis below examines many of these enabling organizations and applies a quantitative, relative ranking of industry reach. NGOs have the most reach in the field (as measured by size, partnerships and organizational focus), followed by foreign aid agencies and then international agencies.

The results show that funding is the most common activity, but technology development is also common. The holes in the industry are in support given to government in five areas:

1. Frameworks for change management and ways to reducing uncertainty stemming budget variances and overspending
2. Tools and techniques to promote sustainability.
3. Training for government ICT workers (training for ICT workers in general is often provided).
4. Evidence to support the decision process employed by governments
5. Advocacy of eHealth in general

The method of analysis focuses on calculating a "Weighted Measure of Reach" for each organization.

Through an extensive review of gray literature and reviews, 71 organizations have been identified working in Africa in the "Enabling" subdomain. Organizations were included when all the following criteria were met: 1) they have significant operations in Africa; 2) they claim to provide services, either paid or unpaid, on projects of other organizations; 3) they provide these services in the fields of ICT, or both health and ICT. Names of organizations were marked for follow-up during the literature review for previous sections though both peer-reviewed and gray literature searches. See Appendix 2 for details on methods employed. The 71 organizations have been broken into 5 subdomains and 18 activities within those subdomains. See figure 4.1 for a listing of the subdomains and activities in the "Enabling" organization domain. Note that this list does not mean to be complete or an accurate sample of the whole industry; it is instead a rough outline on the activity of the industry.

However, global health organizations are extremely diverse in size and reach; one activity may contain 19 very small organizations while another activity may have one very large participant. To compare sectors of the eHealth enabling organization network, a **Weighted Measure of Reach (WMR)** was developed and calculated for each of the 71 organizations. These numerical scores are based on organization size, partnerships, organizational formality, and focus on the use of eSurveillance in Africa; the scores are used to compare strategic groupings in the eHealth industry. See the box below and Appendix 2 for a description of WMR.

The WMR measure uses techniques from the business discipline of competitive analysis (135), specifically competitive arrays. It is prompted by two constraints: first, capturing truly comparative efficacy data for 71 organizations is outside

the scope of the current study. Second, typical competitive analysis relies on reports that can be found on publicly reported financial data or in a company's advertisements (operational data gained in the marketplace). In the global health field, this type of information is rare.

WMR combines relative scorings (developed from public information such as websites or articles) of organization size, partnerships, organizational formality, and focus on the use of eSurveillance in Africa. Each score is weighted and summed to generate a WMR number for each organization. Each organization's main activities are categorized and category subtotals of WMRs can provide rankings on the amount of activity across several dimensions of the industry. Due to the constraints mentioned above, the WMR would not be useful to compare individual organizations, but it can provide a snapshot of the structure of an industry in a bleeding-edge phase.

Appendix 2 has full details of the technique used.

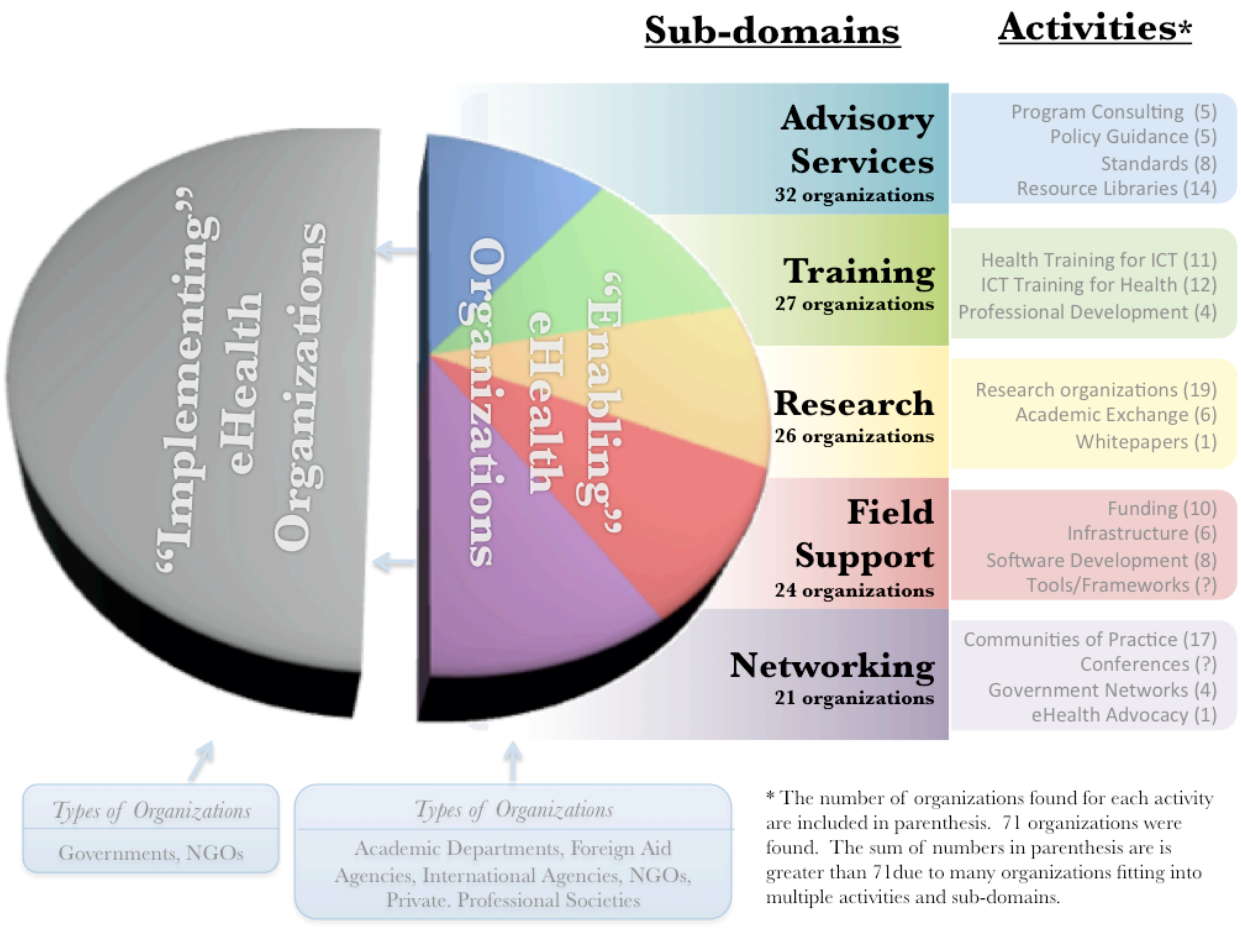


***Figure 4.1**: Mapping of the activities of enabling eHealth organizations in Africa*

Additionally, the organizations can be grouped by type of organization (NGO, foreign aid organization, inernational development agency, etc.) or by the type of audience the organization is primarily serving (government health system leaders, other NGOs, epidemiologists, health workers, etc.). These different aggregations are presented in Appendix 7

for reference. Additionally, by mapping the activities of an organization to the eHealth risks to member states, it is possible to develop a rough understanding of which risks are being addressed by these enabling organizations.

Results: Activities with high WRM

	WMR Sum	Number	Average
Funding	751	10	75
Research organizations	609	19	32
Communities of practice & networkers	576	17	34
Training: ICT	460	12	38
Resource Libraries	322	13	25
Standards and Interoperability	293	9	33
Training: Health	278	11	25
Government Networker	272	8	34
Infrastructure	237	6	40
Consulting or Advisory services	144	5	29
Advocacy	116	2	45
Academic Exchange	115	6	19
Professional Development	98	4	24
Policy Guidance	94	5	19
Change Management	0	0	-

Figure 4.2: *The WRM of each outlined activity of enabling organizations for eHealth*

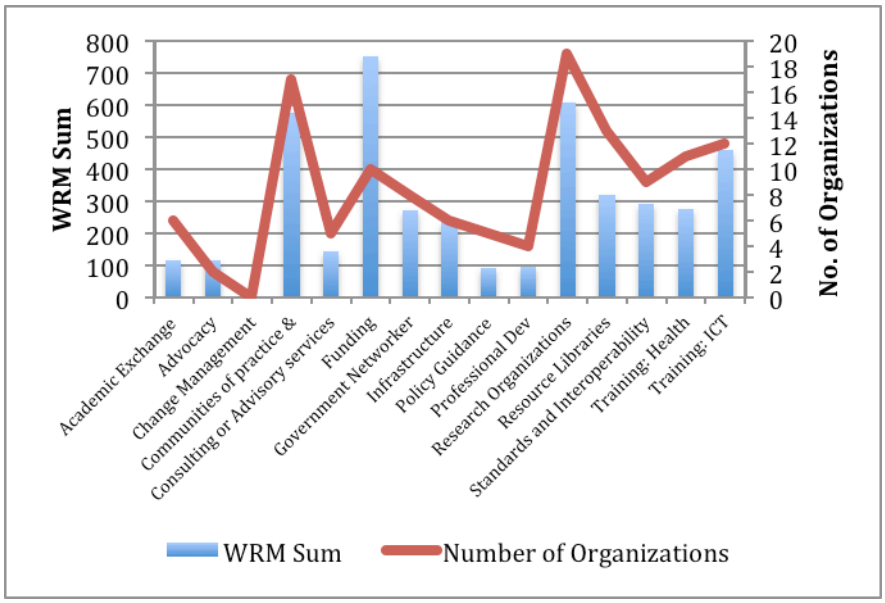


Figure 4.3: *WRM sum and number of organizations for each enabling activity*

1. Funding is a central function of Enabling Organizations

Unsurprisingly, funding is the most common activity of the organizations with the most reach. If we only look at organizations that primarily are geared towards government health system leaders, this lead is starker. Funding has a WRM score twice the size of number 2. Providing funds to address health systems strengthening is clearly a central function of the Enabling community. Second is scientific research into eHealth topics and third is the "Implementing Communities of Practice" activity by organizations that provide online or in-person forums for technical implementers of eHealth.

2. Lack of Technology is <u>not</u> a problem.

A large amount of resources flow to implementation frameworks and technological tools. Many organizations on the list have pilot projects or wide ranging implementations (such as Health Information Systems Program's open sourced DHIS2, which is the national surveillance system in 8 countries). It does not seem that a lack of technology is a problem.

3. Networking is becoming more common.

Finally, the number of networkers also, while not in the top three, is on the top end of the list. Rockefeller Foundation and WHO's Health Metrics Network's networking activities account for most of the WPM in this section, but several sub-regional organizations (in east, central and southern Africa) have been founded in the past years. These organizations are fledgling, but represent a new interest from member states in sub-regional cooperation on disease surveillance.

RESULTS: GAPS IN THE INDUSTRY

THERE ARE THREE MAIN AREAS THAT CAN WOULD SERVE GOVERNMENTS AND PROMOTE EHEALTH.

Summary: Enabling organizations can also be grouped by the governmental risk their services address. If we isolate the organizations that only focus on governments, we can identify several risks that are not well addressed. Change management/adaption risks, risks associated with uncertainty in budgeting, risks stemming from a lack of expertise and risks from a lack of evidence. Finally, there are surprisingly few advocacy resources that actively try to engage governments and the population to adopt eHealth measures.

Risks to governments can be mapped to activities of enabling organizations.

Alternatively, it is possible to map the activities of enabling organizations to the industry-wide risks that entities (especially governments) face in eHealth strategies. Figure 4.4 charts the sum of WRM activities for each of the most significant risks as identified in Section 2.

***Figure 4.4**: WRM calculated for each risk to governments*

Three insights become evident:

1. Several Implementation risks to member states are not being addressed: Adaption/Change Management, Overspending & Sustainability

Mapping eHealth risks to organizational activities shows that there is very little implementation support for government in three areas – adaption/change management, overspending (financial uncertainty in implementation) & sustainability models.

Especially noteworthy is the complete lack of dedicated change management support in the enabling field; while organizations may touch on it though other services, no organization found offers it as a core competency or expertise.

2. When looking at services to governments in particular, two activities stand out: ICT training and Impact risk abatement

ICT Training: Across the industry, there are 12 organizations that participate in training in health for ICT professionals, and the activity is ranked five on the list in terms of WMR. However, when limiting analysis just to organizations aimed at government leaders, 11 organizations disappear and the activity falls to 16[-]. While organizations are training more people in health ICT, they are not doing it for governments—meaning people may be trained and not end up in a government role, negating any advantage. Partnerships with government in ICT training are missing.

Impact Risk Abatement: Likewise, very few organizations provide research services directed to problems faced by government. Most research to this point has been either about the state of the industry (for instance, research about a lack of good research in eHealth) or about whether a specific eHealth intervention is better than no eHealth intervention. While this is good information, these surveys do not speak to the choices a government investing in eHealth has to make—for instance, whether to use SMS or Android mobile phones in their health worker investments. The low WRM score for Impact risk bears this out.

3. There's a lack of advocacy services to cross the eHealth chasm.

Strong advocates for eHealth can make the difference between industry success and failure. An iPhone may be the perfect combination of computer technology, but it does not sell itself: Apple invests millions a year in national advertising. Likewise, eHealth may be the future, but it will not sell itself to the 4 out of 5 governments without national strategies. Having two firms in an advocacy role may not be enough.

Section 5: Responses to Gaps in eHealth

Possible Responses to gaps

The role of "Networker" will address many risks to national governments.

Summary: According to the DOI model, the eHealth industry is facing an "adoption chasm," leading to fragmentation and reduced innovation. More countries need to be convinced to adopt the technology. If enough countries are experimenting and sharing those experiences, the industry will avoid the chasm and move forward. A network is a way to do this.

The desired outcome is to see all countries develop a national strategy.

There is broad consensus in the literature about the need to strengthen national Health Information Services in the developing world (136). The WHO recommended that members develop an eHealth policy in 2005 to achieve this strengthening.

The state of national eHealth policies vary greatly between countries, from fully developed to nonexistent. While the WHO published a list of 16 African countries in 2005 reporting having an “eHealth policy,” no ironclad definition of "policy" was provided (16). As late as 2010, no general account of national eHealth policies was readily available (90). The work of the ITU in the past two years has been to collect whatever documentation produced by countries on their national eHealth strategy (72).

The ITU has developed the most comprehensive toolkit for assisting countries in developing their eHealth strategic plans, including steps to develop a vision, the required components of a comprehensive eHealth system, and an approach to prioritize the most vital systems (73). Through this effort, many governments have started the drafting process with the support of the WHO, ITU, and other international agencies.

While these resources are available, there are still several challenges—the process is expensive, broad expertise in ICT and Public Health is needed, and all good plans need to coordinate several departments. Real commitment to this process is key—outsourcing the decisions to an NGO fails because any recommendations will lack supporting political will (72).

Small, facilitated networks of government public health leaders will speed the update of eHealth.

This section outlines a clear need in the industry: additional networking in a bottom-up, participatory, government-focused fashion. A regional network, using the experience of sub-regional disease surveillance networks as a guide, can provides a clear logic to guide a coordinating body's activities in the eHealth field. Full analysis and description are provided below.

Analysis of two other responses—technology investment and support of standards—is included in the appendices.

Two alternative strategies that are presented in the appendix—support of standards and technology investment. Note that these activities are not mutually exclusive with a network and, especially with standards establishment, can be complementary. However, the work of setting standards is difficult with many players already involved. As venture capitalists can attest, choosing and investing in a technology in an effective way is nearly impossible unless a very large amount of funding is available. The full details are in Appendix 1B.

eHealth Networking: The Basics

Small networks designed to emphasize trust can revolutionize eHealth uptake.

Summary: ***There is a clear gap in sustained, focused networking for the purpose of eHealth advancement. There is tremendous research on formal and informal network building, even within the global health domain. Especially instructive in the global health network is the relatively new movement of sub-regional disease surveillance networks. The successful networks utilize trust-building techniques and feature sustained relationships that are utilized to solve problems of international coordination in disease surveillance. Such an arrangement can assist the industry.***

The Disease Surveillance community has already identified a need to strengthen networking: Sub-regional disease surveillance networks have found increasing interest since the year 1999 (30).

Sub-regional disease surveillance networks are coming together to fight diseases that don't respect international borders.

There's an adage in infectious disease can be paraphrased as "You're only as strong as your neighbor" (30). If you live in Sierra Leone, an outbreak in Ghana might soon affect your population. It's with this realization that sub-regional networks were formed. Starting in the Mekong Delta region in 1999, epidemiologists from neighboring states would come together to establish guidelines of cross-border disease surveillance and practice readiness drills at the busiest crossing points. Soon, sub-regional disease surveillance networks (SRDSN) started in the Middle East (MECIDS, or Middle East Consortium on Infectious Disease Surveillance), the Balkans (SEEHN, or South-Eastern Europe Health Network), east Africa (EIDSNet, or East African Infectious Disease Surveillance Network) and southern Africa (SACIDS, or South African Centre for Infectious Disease Surveillance) (137). Early support for the idea came from the Rockefeller Foundation, though that support has ended. CORDS (the Connecting Organizations for Regional Disease Surveillance) is an NGO designed to support the functioning of these networks (117).

Such organizations have diverse activities, but all support the exchanges of best practices, surveillance tools and strategies. Some networks pool resources to start training courses and technology pilot projects; some practice cross-border outbreak control exercises. These organizations can be hyper active in building outside network connections; the southern African network has over 30 partnerships (30).

These efforts have been met with varying success: the Mekong Delta network has made tremendous progress, and the Middle East network has been very successful. The east African network has atrophied of late (50), though the southern African network has accomplished some impressive feats in disease detection of new pathogens (118). The experiences are instructive on building strong networks.

This movement represents a new model in intergovernmental relationships.

Sub-regional disease surveillance networks are not well established across Africa. While South Africa's network has functioned well, its focus is not on ICT (30). East Africa's network has been beset by organizational issues (50), and West Africa does not have a network. However, a well-designed network could be especially helpful in addressing the risks of eSurveillance.

There is a clear need:

> ***The Identified Need: Bring government planners together to form small, flexible networks designed and funded to address large and small problems in disease surveillance and as a forum to share experiences in eHealth. Such networks, made of epidemiologists, technology managers, and public health career civil servants, will build trust, teamwork and a shared sense of identity. These networks will focus on ICT and increase eHealth adoption in Africa***

Each key concept in the above need statement is examined below:

1. ***"Build trust, teamwork and a shared sense of identity"*: Such a network is reliant above all on building trust, a sense of a shared identity, and a sense of a team.**

   Research shows that one of the best predictors of success for knowledge transfer is the idea of trust (138-140). While trust is a complex concept in network analysis, in short, trust can be defined as “belief that others will not deliberately or knowingly do us harm, if they can avoid it, and will look after our interests, if this is possible” (141). Trust can be seen through basic functions, like asking each other for advice, encouraging new ideas and assisting in their implementation, or tapping into the networks of colleagues' own organizations. Eventually, trust between individuals will be institutionalized and that trust will be towards the organization.

Trust building is key in building strong networks and key to diffusion of innovation in general. Trust is the key norm within disease surveillance groups (49). It is built by feeling a shared sense of identity with the other people in a group. The goal is to have members perceive the members as forming a single entity, rather than being a conglomeration of several groups (142).

Methods of trust building include (142, 143):

- Face-to-face, in-person communication is vitally important.
- Introductory meetings should have emphasis on the shared characteristics of a group. This includes emphasis on mutual threats, shared rewards or consequences of a group's actions, and common ties that a group has.
- Though it might be difficult given typical bandwidth in Africa, virtual meetings with face-to-face video establishes trust much more than conference calls.
- For committee structures, overlapping subcommittee assignments (where people are on multiple subcommittees, with different colleagues) work best.
- Formal operating rules, feedback, and conflict resolution can improve trust.

2. "*Epidemiologists, technology managers, and public health career civil servants*": The same people need to keep returning to the meetings and have the same vocabulary.

The East African sub-regional disease surveillance network (EAIDSNet) was established as a meeting place for East African public health but was plagued by a turnover of members. Its membership was political leaders, not public health leaders, and they often moved onto other posts. The process of group normalization and trust-building had to restart several times (49).

Conversely, the representatives from MEIDS (the sub regional network in the Middle East) talked about establishing trust by seeing the same people over and over. These people had corresponding public health jobs on the other side of the border (across the fraught Israeli-Jordanian border, no less). They all spoke the same language. As one MEIDS participant said, "Morbidity is morbidity, a reagent is a reagent, … I know what he [his MECIDS counterpart] is thinking" (49). Turnover was also a smaller issue.

3. ***"Large and small problems"*: The process starts not by tackling large problems but by choosing a small, common problem that can lead to early success.**

People feel a part of a team when they are working on projects cooperatively; however, large projects typically require large investments and more trust building. Small projects (such as border protocols or small cross-border training drills) are also likely to create early wins for the network. This experience is underscored in sub-regional disease surveillance: one member of MEIS, when approached said, "if this [organization] was just talk, I would not come to the meetings" (49).

4. ***"Small [networks]"*: The core network(s) for member states should be kept small and restricted to countries with similar political, geographic and economic profiles.**

First, fewer nodes means stronger relationships; having representatives in the room who might be from a different region and of a different stage in eHealth development will sap the feeling of team (49). Putting a cap on membership size of each network will produce better results.

Second, as has been shown in political literature, states will take up ideas of other states that have close ties. Initially these ties are typically economic; later, as the ideas and relationships develop, it is more political ties (144). Research is quite clear that homophilious groups are the best way to spread innovation—ideas are likely to spread between states that look like each other. If two actors have the same profile economically, are similar politically and are geographically close, there is greater likelihood that ideas will spread between them.

5. ***"Flexible networks"*: Networks will evolve; 5 year plans will not work.**

As entrepreneurs have found, the case of any strategic plan, the concept at the beginning of the process usually looks very different from the end of the process (145). Experimentation and flexibility is the key to success. Thus, there is a need to begin (even on small projects) as soon as possible.

In successful sub-regional disease surveillance networks (such as MECIDS and MBDS), members were the ones to define the goals and structure of the group, and the work did not take place on politically determined timetables. Success was due in part to the bottom-up structure of the effort (49).

6. ***"Funded"*: Such networks do not work without funding, for both operating costs and special projects.**

A major issue with EAIDSnet was the lack of funding; it received about US$800,000 from the Rockefeller foundation for 6 years of work; however, it ran out of funds and was folded into the East African Community. This period of bureaucratic uncertainty damaged the network and led to it being subsumed by the more formal structures of the EAC (50).

Previous experience shows that any effort or any global authority with convening aspirations will need funding to offer participants. All previous efforts without significant funds were doomed to failure (146).

7. ***"Increase eHealth adoption in Africa"*: *An agenda can be set to maximize the spread of eHealth specifically.***

While the members should set the strategic direction of group, the convening body may be able to push the dialog towards sharing experiences of ICT implementation. If early adopting members can share examples of successful implementations, the other members will be more likely to copy those examples. Specifically, the DOI model holds that innovations with the following characteristics will diffuse best (147):

- **Easily trialed:** The option to use an innovation without total commitment or large investment will encourage adoption.

- **Easily observed:** If potential adopters can see the progress and pitfalls that other adopters make, the will be more likely to adopt themselves.
- **Easily communicated:** The ease of communicate on topics of interest to adopters will influence eventual rate of adoption.
- **Generally compatible:** If a new technology can fit into current processes, adoption will be sped.
- **Generally similar:** Members with a similar profiles will be more influential on each other
- **Popular especially with opinion-makers:** If the most respected or generally listened-to group members adopt an innovation, adoption by others will be more likely.

A convening/coordinating body may be able to find examples that fit these criteria and share those examples in the network.

Roles of a Coordinating Body

A coordinating body can contribute in three roles set out by the DOI model.

Summary: Roles are outlined by the DOI model, and a coordinating body can maximize its impact by explicitly filling each of those three roles: a coordinator to convene the group and bring in resources, an expert to ask questions, and a salesperson to make a pitch to governments that are on the fence. The role of each is discussed.

The DOI model specifies four different methods of diffusion: coercion (being forced by an authority, or provided extrinsic incentives), competition (trying to gain contested resources), learning (increasing awareness of benefits) and emulation (setting social norms). A coordinating body in Africa would have little coercive power without serious funding; and competition is unlikely to be effective for eHealth, unless a case can be made that eHealth will spur a strong ICT industry. But a coordinating body can use learning to increase awareness of eHealth benefits to set norms in Africa about eHealth.

DOI model also specifies three roles that are used to spur innovation through learning and emulation. In the eHealth industry, these three roles represent a gap that sorely needs to be filled: really, there is only one organization (the ITU) that attempts to fill these roles. There is a much greater need for services along these three lines (51):

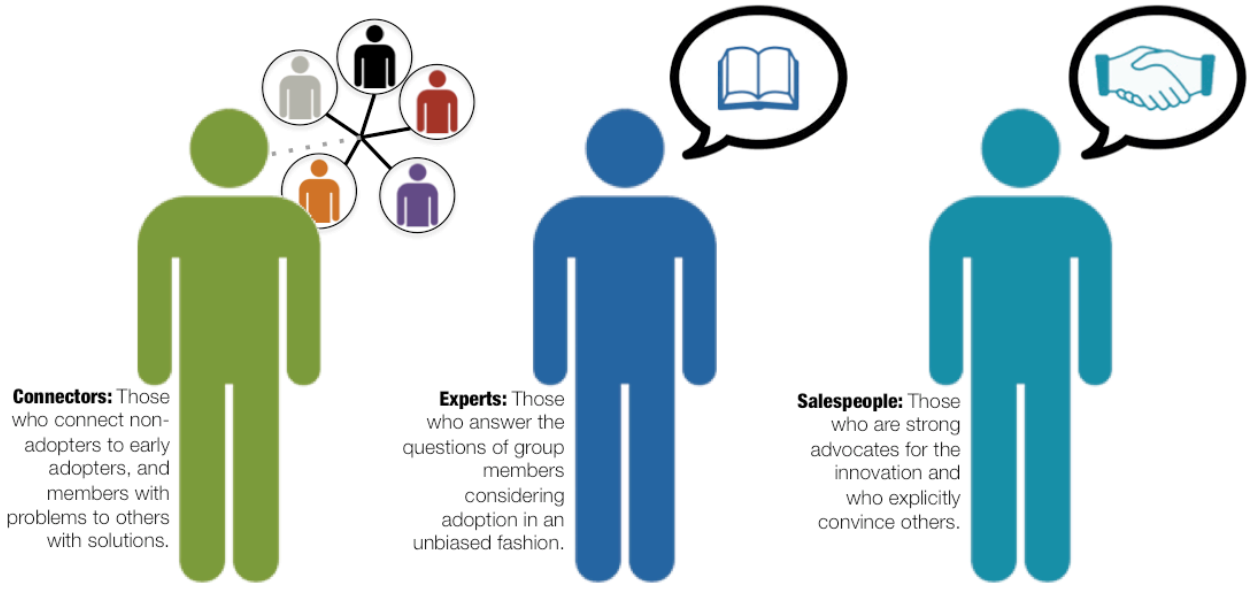


***Figure 5.1**: Three roles to spur adoption of innovations*

1. Connectors: Early Adopters need to be connected to all other nations.

As policy experts have outlined, innovation between countries happens best when leaders are among their peers in the international community. Today, some countries have more experience than others when it comes to eHealth. Uganda is struggling with a deluge of pilots, while Namibia has just started to use EMRs in their hospitals. Connecting the leading countries with the lagging countries can prompt a healthy exchange in learning and strengthen the international expectations set out in the 2005 WHO declaration that eHealth is expected from all governments.

Secondly, risk sharing is a powerful tool at the disposal of especially smaller countries. Scale is important in eSurveillance—it brings down the cost of innovation and increases bargaining power. If smaller countries can pool resources to start new projects or negotiate with technology providers together, they will reduce costs (148). This type of connection can be built in a networking space.

Thirdly, the leading countries can be connected to set standards in eHealth. If larger players in any field set standards, it's been shown that those standards will be more quickly adopted by smaller players (22). The US state of California is instructive—the US lacked fuel efficiency standards until the state of California set its own in the 1970s. Soon other states followed, and eventually the US government was prompted to make uniform standards (149). In international relations, no body has the same governing power, but the de facto standards can be established in an eHealth collaborative body.

2. Experts: Smart support for Early Adopters can make a huge difference.

As outlined above in Section 3, countries face tremendous risks in implementing eHealth systems. Their ICT departments are understaffed and overworked. Technology infrastructure can get expensive quickly. There's no guarantee that health workers will take the system, or that there will be a visible impact on health outcomes.

But there are countries willing to take the leap of faith that eHealth requires. Rwanda has implemented a huge eHealth system to track HIV patient progress (5). Kenya has committed to using DHIS2 as the backbone of its eSurveillance system (150). South Africa has provided national research funds to study eHealth (151).

These early adopters need to be supported with training or financial support for ICT staff. There can be linkages between those staff members and institutions in the Global North with decades of Public Health Informatics experience.

Mavens/experts can be provided on change management techniques to improve uptake of technology. International press coverage can be garnered to boost the profile of the leaders really investing in eHealth.

Strong support for the problems that plague governments will convince others to take up eHealth. For an eHealth coordinating body, this may be as simple as dividing member states into homophilious groups (based on economic, geographic and political ties and similarities) and deciding which countries are the eHealth leaders in each of those spaces.

3. Salespeople: Cheerleaders for eHealth are needed.

The network facilitators should study trials from Early Adopters carefully to discover how to make their ideas for eHealth or eSurveillance projects more convenient, low cost and marketable. The industry has three organizations that do what can be termed "advocacy" (WHO's Health Metrics Network, the ITU, and the Rockefeller Foundation), but it needs more when convincing governments to make multi-million dollar, transformative changes. A dedicated staff of "cheerleaders" who can talk to political leaders or other stakeholders about eHealth will help the industry move forward.

If effective in these three roles, any coordinating body would significantly speed the uptake of eHealth technology, and make a tremendous impact in the fight against infectious and emergent disease.

The Problems That a Strong Network Solves

Building trust is the key to any network.

Summary: ***The impact of a strong network can be profound—both for governments investing in eHealth and for the organization that is responsible for building such a network. The spillover effects can lay groundwork for other international efforts.***

There are three benefits to the industry.

1. **A network can mitigate a slew of risks for eHealth-implementing countries.**

For instance, building technology crucibles, where several states have an interest in the outcome of a study, but no one state is responsible for all the resources can effectively share risk (118). Standards can also be set though networks—in fact, that's the only way to set standards (108).

The risks outlined above in the landscape analysis of enabling organizations revealed five risks that are significant and not addressed by the industry: adoption risk, overspending risk, sustainability risk, technical talent risk, and impact risk. Each of these can be well addressed by an intelligently designed network.

- **Adaption risk**: Change management best practices and frameworks can be created based on the experience of governments
- **Overspending risk**: Designing an insurance pool that can be tapped by governments may reduce the budgetary uncertainty of projects
- **Sustainability risk**: This risk is more difficult to address, but a central networking body could provide a forum to meet the key task for public-private partnerships: nurturing relationships.
- **Technical talent risk**: Having ICT and public health leaders interacting with each other is the best way to increase capacity of government works.

- **Impact risk**: Some sub-regional disease surveillance networks already feature a "technology crucible," where projects are studied to provide answers for government decision-makers. A committee of technical experts also can gather evidence on successful interventions.

In fact, as figure 5.2 shows, a network can address a host of risks.

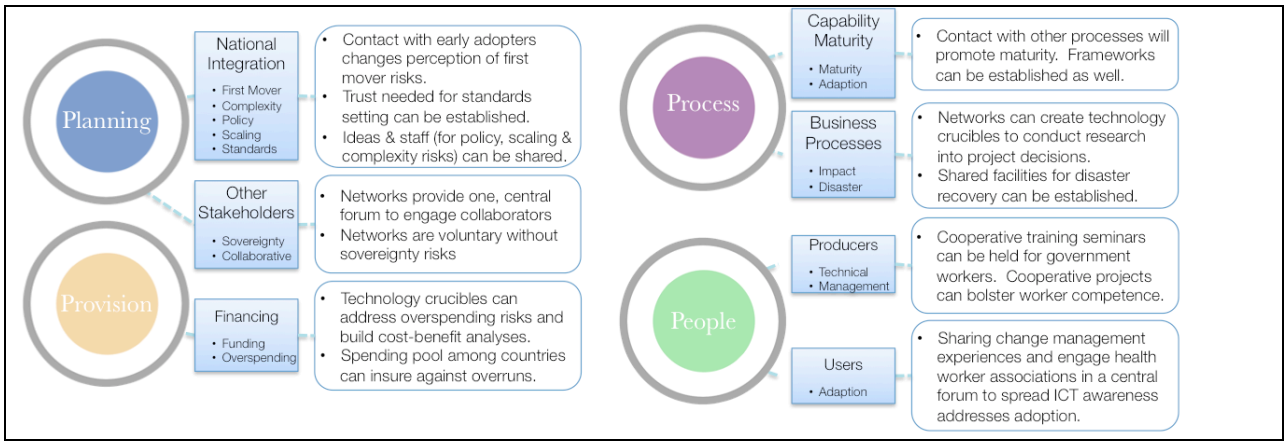


***Figure 5.2**: Risks addressed by a permanent, participatory network of public health leaders*

2. **Strengthening national networks will strengthen national systems, especially in IDSR and IHR projects.**

As experience with IHR and IDSR shows, the more contact with networks and the more responsibility a country has to other countries, the more mature their own systems have to become. IHR improvement processes show that when a country improves one IHR capability, future capabilities become easier to address (30). The same process can happen with eHealth through sub-regional networks. If countries are prompted to learn from and experiment with neighbors (in a lower-risk environment), their future efforts in eHealth will be easier.

In fact, other projects associated with IHR and IDSR can be promoted through these same channels; strengthening personal, working relationships with leaders in the public health department will have spillover effects into other efforts.

3. **Research shows that peer sharing is the best way to quicken adoption of a new idea.**

It bears repeating: increasing adoption of eHealth is vital to minimize the risk of the eHealth industry "falling into the Adoption Chasm." Peer sharing (even on a policy level) is a very effective method, and adoption happens quicker through peer sharing than a top-down structure (22). A network featuring experts who can work together on problems and share experiences over several years is well suited to promote peer sharing (49).

There are three benefits to a coordinating body.

1. **Such a network would not be completely novel; it would build on CDC & WHO/AFRO experience.**

In an increasingly interconnected international landscape, the international system will be a mix of multiple, overlapping systems and networks (152). An organization like the WHO, with its privileged place in the international community, can be an orchestrator and strong supporter of many of the other networks, strengthening the organization.

In fact, the CDC Foundation and the WHO have already engaged in sub-regional, disease surveillance activities with a five year project in Central Africa. SURVAC (le Projet de Renforcement de la Surveillance en Afrique Centrale), funded with a USD $25 million grant from the Gates Foundation, helps three francophone countries improve disease surveillance capacity (153).

2. **Funders will support the organizations with the closest ties to multiple governments.**

The stark reality is that there are many organizations trying to improve eHealth. However, as eHealth moves towards national consolidation, the focus of the industry will shift to governments. Helping governments do their work, rather than helping NGOs, will provide the greatest benefit to people.

Any organization that sits at the center of the discussion for eHealth and becomes a trusted advisor to those governments in eHealth will provide unique value to funders looking to improve health in Africa. Major funders can import expertise in ICT from the Global North (for a high price and probably unsustainably); they can provide funds to governments to support projects; they can even hire experts to determine what the best standards for Africa can be.

The core competency that funders cannot easily obtain is a trusted relationship with key government decision makers and implementers. A networked organization can build that trusted relationship over several years.

3. **A networking infrastructure provides a clear purpose, but in a capacity designed to grow.**

The eHealth landscape is littered with organizations that fail. Beyond pilot projects (of which there are thousands of examples of failures), even enabling organizations will fail. Unfortunately, many WHO efforts fall into this trap—the African Health Infoway, the eHealth Standardization Coordination Group, the Open Concept Collaborative, SemanticHealth, and the SHIPD project all either no longer function or no longer publish any materials about their activities.

In general, it is the organizations that have a very specific and obtainable mandate that survive over the long haul. The WHO ePortugese program is a great example: its mandate is to provide materials for health in the Portuguese language. The organization is an extremely responsive one.

However, especially in technology, if you don't change, you fade away. Having a specific but flexible mandate is difficult to obtain, but a network can solve such a problem.

Appendices

APPENDIX 1: ANALYSIS OF OTHER RELATED EHEALTH COORDINATION ACTIVITES

A. SETTING STANDARDS

ESTABLISHING NORMS IS THE KEY TO SUCCESSFUL PROPOGATION OF STANDARDS.

Interest in setting standards has increased tremendously in the last 5 years; 81% of articles on mHealth standards or interoperability have been published since 2008. Standards—reducing problems of interoperability between technology and helping to ensure adherence to national policy—is an important response to the problems of "pilot-itis" and the extreme fragmentation of the eHealth industry.

There are several organizations working on standards. They fall into three types (55):

1. **Standards Development Organizations (SDOs)**: Organizations like the ISO Technical Committee 215, HL7 and IHE will, in consultation with stakeholders across the industry, develop standards for a specific vertical.
2. **Standards Coordinating Bodies**: The Joint Initiative Council (JIC) brings together seven SDOs, promoting their operations and resolving any conflicts between standards.
3. **Standards Implementation Support**: Organizations such as ITU, the WHO's Department of Knowledge Management and Sharing or the Global Observatory for eHealth, encourage adoption and convene discussion on standards.

The review of the eHealth industry produces five insights on standards that may be of interest to a coordinating body entering the eHealth space:

1. **Standards are important, but will not spur eHealth investment by themselves**: Standards can improve the flow of data within a system and improve governance of a system; in general, system-wide costs should decrease. Individuals may be incentivized to enter ICT, as the training they receive in one system can be used

across the continent in a standards-based environment. But standards will not obviate many of the risks outlined above; for instance, governments will still need experts in ICT, managers of Public Health technology, significant funding and robust change management processes.

2. **Many organizations (even within the WHO) have tried and failed to set standards in Africa**: The 2005 WHO declaration on eHealth talked about the importance of standards; the WHO has had standardization board and organizations responsible for setting standards. The HMN chose standards for the collection and use of health information in 2008 (154), but adoption has not happened. Several meetings take place on standards each year, it seems. UNICEF hosted the most recent in Rwanda in July of 2012, featuring top ministries. There is a lot of activity, and not much success in this area: any new activity would need a new approach.

3. **There are several expert organizations creating standards, but there is an unmet need for standards in LMIC-specific technology**: The JIC has seven influential members who are very engaged in the process; additionally, the WHO's Family of International Classifications also is a very intensive effort to establish standards for the world. The process for setting standards is expensive, technically difficult, and requires the buy-in from many partners; these organizations have done tremendous amounts of work to establish the standards they have.

   However, the ISO eHealth committees and HL7 are mainly composed of members from North America or Europe. Africa only has 7 members of the pertinent ISO committees, and no representation on HL7 committees (55). Membership in standards organizations is generally expensive. Consequently, there are range of standards for eHealth, but are needed for eHealth in low-resource settings—for instance in SMS security (55).

4. **In the absence of a governing body that can legislate (read: force) standards, standards are set by a norms-building process**: Having smart standards is necessary but not sufficient to see that they are adopted. Standards adoption can be an expensive and difficult process: the discussion of standards has taken place for

years, but few LMIC countries have adopted strong standards. The most successful processes (in absence of a body that can compel organizations through use of law or funds) will rely on setting norms (22). The standards history of the EU is illustrative (16).

Experience shows that if a larger, trend-setting country sets standards, many other countries will follow. The classic example is automotive fuel efficiency standards in the United States. It was the state of California that first enacted standards in the 1970s; soon, other states adopted similar standards. Eventually, the US federal government was compelled to act by these states to establish nation-wide standards (149).

Standards setting is a long exercise that relies first and foremost on trust; if a country's leaders do not believe that other countries can be held accountable to adopt similar standards, they will not be the first movers. It is in this way that a network can be helpful in setting standards (142)

5. **For a country, choosing the "right" standard is less important than choosing any standard**: While somewhat counter-intuitive, the EU's experience in eHealth standards show that if a country successfully adopts a standard, it will be much easier to switch standards later (155). If all systems "speak" the same language, "translation" to another language only has to happen once across the system. The most costly process is the first step of ensuring myriad systems can talk the same language.

6. **The costs associated with standards will fall on technology implementers—this mostly means NGOs**: The task of re-coding systems to output information in a specific format or understand input that assumes a specific vocabulary falls to the designers of those systems. In most cases, these are NGOs (55). Damaging relationships with NGOs is a significant risk for governments implementing standards. A central forum (such as a sub-regional network) to engage NGOs abut standards would help mitigate this risk.

B. Investing in Technology

Creating or promtoing specific technologies is extremely risky.

In the end, technology is a very difficult field to choose winners in; until systems have been out in the field, is almost impossible to pick winners. Those who do so for a living generally have very diversified portfolios of at least 30 companies. Furthermore, in Africa, it is not more technology that is needed for eSurveillance—it is the systems to support and customize the technology that global health already has.

The Need for Direct Technology Investments: Low

As outlined in the above discussion of IDSR and eSurveillance, an extremely wide range of tools exists now that can be used to improve disease surveillance. In eHealth, constraints have lifted on both hardware and software: mobile phones and computers have become much cheaper, and the internet and open source software techniques allow professionals from all over the world to create high quality software. The electricity infrastructure, internet availability and techniques in change management have yet to catch up. These factors are the bottlenecks in the system (16).

The Likelihood of Success for Direct Technology Investments: Risky

Picking winners in technology is next to impossible—the market is too unpredictable. Direct investment in technology can take two forms:

1. Engaging a company to create new technology
2. Selecting a product and advocating for it or providing a grant to an NGO or government to implement

In the first case, the investors act very much like a venture capital company putting funds behind a product they feel will make money. However, Silicon Valley shows how risky venture capital can be: billions are lost each year by whole firms studying the market full-time. Venture capitalists only succeed a sliver of time: a VC firm is successful if one out of ten investments make it big (145). Additionally, technology changes so rapidly that something successful now will be obsolete in 5 years (74, 156). At least one "cutting edge project" from 2004 was run on Palm Pilots; that project is now hampered by the obsolescence of the Palm Pilot platform.

In the second case, selecting a product on behalf of a implementing organization will create misaligned system requirements; the best judge of a system will be those who will use it. Local needs are complex and varied across the continent.

Alternative Strategies: Enterprise Architectures

Health Enterprise Architecture—designing flexible, vendor-neutral frameworks to employ standards and guide the development of applications, customizations and add-ons (157)—may better serve the needs of member states as they make their own decisions and reduce the cost of system development (110). This work is already being done already in Africa. At least two credible projects are undertaking this: Health Enterprise Architecture Laboratory (HEAL) at the University of KwaZulu-Natal, and the Rwanda Health Enterprise Architecture, run by Jembi, Inc. with the support of IDRC, Rockefeller Foundation, PEPFAR and the HIPPP.

Appendix 2: Methodologies

Several analyses were undertaken: literature review, a risk assessment and an organizational review. The literature review is outlined in the next section, and the risk assessment methodology is outlined in Section 3.

IRB Approval

An IRB exemption ruling was obtained from Emory University's IRB and documented. Background interviews (of a purely professional nature about the eHealth industry) were conducted, but no other human subjects were used in this report.

Organizational Review

Through an extensive review of gray literature and reviews, organizations have been identified working in Africa in the "Enabling" subdomain. Organizations were included when all the following criteria were met:

1.) Significant operations in Africa;

2.) Provision of services, either paid or unpaid, on projects of other organizations;

3.) Provision of these services in the fields of ICT, or both health and ICT.

Names of organizations were marked for follow-up during the literature review for previous sections, though both peer-reviewed and gray literature searches. The 71 organizations were broken into 5 subdomains and 18 activities within those subdomains.

To compare sectors of the eHealth enabling organization network, a **Weighted Measure of Reach (WMR)** was developed and calculated for each of the 71 organizations.

The WMR measure uses techniques from the business discipline of competitive analysis, specifically competitive arrays. Previous research has determine the appropriateness of using competitive analysis in the nonprofit field; while parameters and metrics of

The technique is prompted by two constraints: first, capturing truly comparative efficacy data for 71 organizations is outside the scope of the current study. Second, typical competitive analysis relies on reports that can be found either on a government websites (publicly reported financial data) or in a company's advertisements (operational data gained in the marketplace); in the global health field, this type of information is rare.

WMR combines relative scorings (developed from public information such as websites or articles) of organization size, partnerships, organizational formality, and focus on the use of eSurveillance in Africa. Each score is weighted and summed to generate a WMR number for each organization. Each organization's main activities are categorized and category subtotals of WMRs can provide rankings on the amount of activity across several dimensions of the industry. Due to the constraints mentioned above, the WMR would not be useful to compare individual organizations, but it can provide a snapshot of the structure of an industry in a bleeding-edge phase.

These numerical scores are based on the following:

Organization Size: Without standardized reporting, size is often difficult to ascertain. Websites and publications about organizations were examined for the number of staff members associated with an organization. If no staff size could be calculated, any budget figures were converted; it was estimated that each staff member was the equivalent of US$100,000 of grants or received monies. If no budget figures were available, a staff size was estimated based on the staff sizes of peer organizations that produced roughly the same output. Size varied, so it was used in a logarithmic scale.

Organizational Staff Focus: Very often, organizations or partnerships are part-time projects for staff members. Based on a rough estimate, the percentage of time dedicated to a project is estimated and scored as follows:

Description	Score
Seemingly volunteers without funding	1
Staff that spends less than 25% of time on project	2
Staff that spends around 50% of time on projects	3
Staff that spends majority of time on projects	4
Dedicated Staff full time on projects	5

Organizational Formality: Having an organization behind work provides structure and resources for a project. However, it also can possibly lead to outside bodies setting priorities or imposing restrictions. Organizational formality is scored as follows:

Description	Score
No incorporated body	1
Formally constructed body or corporation, but actions negotiated by committee of outside actors	2
One section of a larger organization or international agency; that larger organization can determine funding and oversight	3
Dedicated body or corporation with strong leaders that set their own strategic direction, but beholden to funders	4
Independent body or corporation without donors; or highly diversified donors; or with very well-established institutional stability	5

Partnerships: Partnerships for each organization were determined based on websites and published materials. All of the partners were scored by using information from www.SEOMoz.com, which aggregates information about a site's popularity on the web. (A similar system, Page Rank, is used on the Google search engine). For purposes of simplicity, it is assumed that more popularity translates into more organization clout and stronger partners to have. The SEOMoz scores for all partners of an organization were summed and scaled logarithmically.

Exposure: Page Authority is a score from www.SEOMoz.com. The homepage of each site's score for "Page Authority" was captured from SEOMoz to represent the clout or awareness the broad community has of an organization. This is a more sophisticated form of adding up the number of pages Google might find that mention an organization.

eSurveillance Focus: The ratings are meant to focus on aspects of eSurveillance. To represent this, the activities of each enabling organization were categorized and scored. Each organization received a score of zero to 5; having operations in each of the following increases an organization's eSurveillance Focus score by one:

Description	Score
Disease Surveillance	+1
Health	+1
Africa Focus	+1

Focus on Developing Countries	+1
ICT	+1

WRM = 2 x (eSurveillance Focus)^2 x (Organizational Size) +
(Organizational Structure + Partnerships + Exposure)

Weights were determined and validated by comparing results to organizations consistently identified in the literature review as important organizations in eSurveillance (such as the WHO and Rockefeller Foundation) that the literature.

APPENDIX 3: LITERATURE REVIEW

Peer Reviewed Article Review

The purpose of the article review was not to find gaps in the literature, but to develop a database of useful articles that could inform the ASIGB strategy-setting process. The main purpose of this report is to support the work of high-level public health officials who may not have much exposure to eHealth or technology. The literature review is designed to provide a broad range of information that can be pulled into the report to provide a holistic view of a very complex industry in as brief an overview as possible.

The literature review consisted of a search of PubMed for terms related to eSurveillance and restricted to the African context. eHealth search terms included:

1. eHealth
2. Electronic Health
3. Public Health Informatics
4. eSurveillance

Search terms for Africa included:

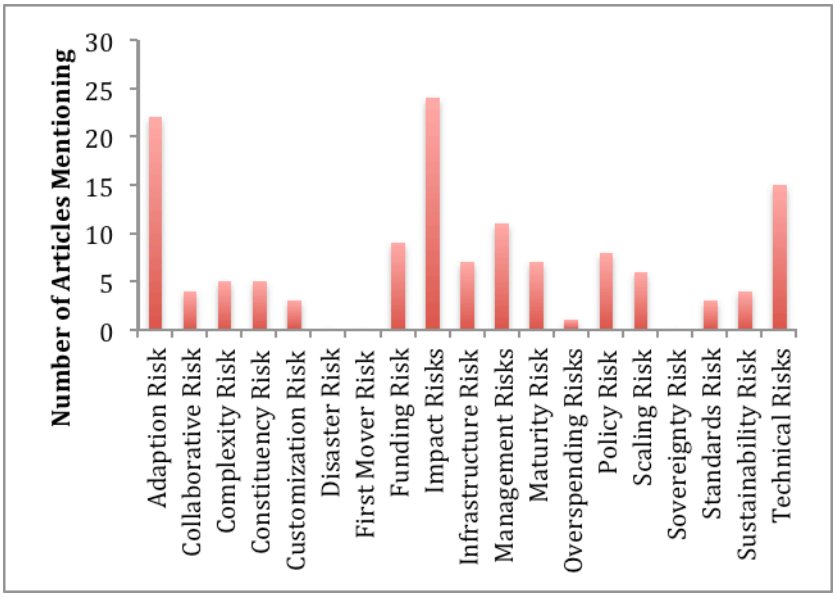
1. Africa
2. A combination search of all countries within Africa

To restrict the search to recent material, a timeframe of 2008 years was imposed. After screening for duplicates, 1,790 articles were found. The exclusion criteria were used as follows:

- Literature not primarily focused on eHealth in LMIC were excluded
- Literature not referencing at least one of two areas: Risks involved to governments in eHealth national strategies and implementations, and overviews or lists of enabling organizations

There were 68 articles that passed the screen. Of these:

- 79% (54 articles) referenced risks to governments in some way. The risks identified broke down to:



- Only 7% (5) touched on surveillance (7, 56, 67, 89, 158).
- 18% (12) were inventories of eHealth implementations.

By far the biggest theme across the literature were the problems in the industry: 68% (46) articles touched on some shortcoming of the eHealth industry as it stands. Thus, it was clear that this report should not overlap much with the plethora of authors pointing out weaknesses. Any discussion of problems in the industry should be kept short.

Regarding the three areas that this report touched on:

- Enabling Organizations: 24% (16) had discussion of at least one enabling organization. But no article found had a systematic comparison of the landscape of the industry.
- Risks to Government in Implementation: 25% (17) could be classified as touching on issues that a government decision-maker would have to address. This perspective is important to the ASIGB: the organization is created to serve member states as they adopt eHealth.

Overall in the literature, there was a lot of overlap: the eHealth field is presented as exciting, but very nascent. The problems described included a lack of expertise, evidence and experience in the field. Few published literature pieces provided practical advice or implementation assistance.

Gray Literature Article Review

Equally important in this nascent field is gray literature: there is a wealth of white papers, PowerPoint presentations, conference proceedings and book chapters that provide new perspective and quality evidence or frameworks. Through a thorough search of enabling organizations (described above), many documents from a gray literature search were located. The references in each (plus references in the peer-reviewed literature) were examined to add to the gray literature database. In the end, 154 documents were identified and considered for inclusion as a source in the main paper. Each document was scored for relevance to the topics of the eHealth industry and selected for inclusion in appropriate placesbased on quality of research presented.

APPENDIX 4: MARKET SIZING

Total Healthcare Spending for LMIC Countries (non-BRIC)	$1 Trillion	WHO Figures
Total African Healthcare Spending	$130 B	WHO Figures
Proportion of African Spending	13%	Calculation
Total eHealth Spending - LMIC (Non-BRIC) countries	$2 B	Boston Consulting Group
African eHealth Spending in 2010	$258 M	(Based on 13% calculation)
African eHealth Spending in 2013	$382 M	Assuming 14% CAGR
African eHealth Spending per capita	$0.45	Population from WHO

Appendix 5: Software for IDSR-Related Tasks

A vision of eSurveillance in an IDSR context is presented below. The names in brackets represents software that is in the field that could meet the functionality outlined.

Community Level:

1. *Identify & Report*: Public Health officials efficiently notify leaders (over SMS or other electronic notification system) to be on the look out of certain symptoms, and give them a number to call or text to report any suspected infection. Instead of calling each leader or managing hundreds of text messages, they send out a broadcast message typed into a computer. The notification system can automatically forward reports to investigators. *[RapidSMS]*

2. *Respond*: If an outbreak does occur, Public Health officials immediately notify all leaders in each community of the situation easily, keeping them freed up to do other vital tasks. *[RapidSMS]*

3. *Communicate*: These same Public Health officials keep the lines of communication open, providing updates periodically on the progress of any investigation. *[RapidSMS]*

4. *Evaluate*: After an outbreak, community leaders are be polled over SMS—they can be sent a link or a number of questions that they respond to. This makes evaluation much more cost effective. *[GeoPoll]*

5. *Prepare:* Community-based surveillance through questionnaires are be polled using the same technology. *[GeoPoll]*

Health Facility Level:

1. *Identify*: Case identification is facilitated using standardized decision tree tools run on electronic cases; this might be a computer program or a smart phone app that guides a user through several questions. *[D-tree]* Local lab workers are plugged into wide networks and given sophisticated tools to identify new pathogens. *[PATRIC]* Any specimens sent to

other facilities are tracked electronically with bar codes, much like packages are tracked with FedEx/other Global North package companies. *[ILSGateway]*

2. *Report*: Routine reporting takes place over SMS or a computer network—clinics that do not have computers send daily/weekly/monthly through a structured text message. *[Frontline SMS]*

   But note that the change from eHealth goes beyond translating paper processes to electronic processes: eventually, electronic medical record systems will obviate most traditional reporting. When a citizen visits a clinic or is visited by a health worker, that health worker submits updates to an electronic medical record based on examination of the patient. Lab results are also added to records. *[Open MRS]* All reporting is kept in a central database and that database is scanned to generate aggregate statistics. The management of Community Health Workers is tied into this data; missed examinations are highlighted for immediate follow-up. [*ChildCount+*] All of this takes place on schedule automatically and nearly instantly, promoting more responsiveness, accuracy and accountability.

3. *Analyze*: A program flags any concerning trends automatically for clinician follow-up. [*Mobile Medic*] Graphs and charts of aggregated data are easily printed or displayed. [*DHIS2 & ChildCount+*] In this step of the IDSR, the only activity that will not be done by a machine is interpreting results and initiating public health actions: human judgment is needed in these cases.

4. *Respond*: Case management guidelines can be presented in a decision tree to best ensure understanding and compliance—that is, district health workers are presented an interface to walk them through a logic tree. *[D-Tree]* Judgment of health professionals is needed to know which control measures are appropriate for the local population.

5. *Communicate*: Reports to leaders can be handled automatically; results are emailed or sent over SMS to district leaders. *[RapidSMS]*

6. *Evaluate*: Management reports are created to evaluate the performance of clinicians and community health workers. *[ChildCount+]* Automatic follow-up questionnaires are generated and sent to clinicians over SMS to evaluate

responses after outbreaks. *[GeoPoll]* Judgment is needed to adjust processes; however, any system should be able to make updates to processes as efficient as possible.

7. *Prepare*: Simulations of outbreaks can take place over reporting systems. *[Mobile Medic]* Training materials for the community can be shared electronically. *[PAHO Virtual Campus]*

District, State, Province Level:

1. *Identify*: Any health clinics that do not submit reports are automatically reminded at the deadline by the computer program, and sanity checks are run by the computer program to ensure reliability. *[DHIS2 & Mobile Medic]* Lab results can be received and sent through a tracking system. *[OpenMRS]* Labs can use open source tools to improve identification of new pathogens. *[PATRIC]*

2. *Report*: All data filters up to the national system without needed action. *[ChildCount+ and DHIS2]* Risk assessments will need professional judgment.

3. *Analyze*: At any point, public health leaders can log into a dashboard that instantly pulls aggregated information from health records into reports representing the health of the district or nation. *[ChildCount+ and DHIS2]* Data submitted from passive and active veterinary routine reporting also filters into these reports. *[DHIS2]* Data across a district/state/province is checked for signs of outbreak. *[ChildCount+ and DHIS2]*

4. *Investigate*: Rapid Response Teams can visit areas with full information on the geographic and demographic details of the outbreak. *[ChildCount+]* Teams are fitted with mobile survey technology that can increase data collection speed and accuracy—their surveys can be handled on smartphones or tablets. *[Magpi]*

5. *Respond*: Technology helps run better, more thorough coordination of mass vaccination campaigns, as EMR systems have created a virtual census of all the children in an area. *[ChildCount+]* Epidemiological notices and educational materials are pushed to all health workers in the affected areas *[PAHO Virtual Campus]*, and primary care workers are

prompted to collect new pieces of data on patients that are integrated into the medical records of patients. *[OpenMRS]*

6. *Communicate*: Outbreak conditions can be automatically shared with neighboring districts, and health clinics receive periodic updates of district activity. *[MobileMedic & DHIS2]*

7. *Evaluate*: Much like the health clinic level, management efficiency reports can be generated for all clinics. Using statistical techniques, systems can cross-check medical data received with that of neighboring districts or other surveys. *[DHIS2 & ClusterSeer]* Supervisory visits, however, must be done in person.

8. *Prepare*: Simulations of outbreaks can take place over reporting systems. *[MedicMobile]* Training materials for the health clinics can be shared electronically. *[PAHO Virtual Campus]* All technical development & support will come from African ICT resources and human capital, so fixing any problem areas will be less expensive and more responsive. Much of the staff management of response teams must be handled personally, however.

National & WHO Regional Office Levels:

1. *Identify*: Professional links established by international cooperation during eHealth system construction can be used to share best practice for national policy. National laboratories can use open source tools to confirm new pathogens. *[PATRIC]* Use of Google Trend analysis to identify outbreaks based on a population's search for symptoms shows promise as a tool; eventually, it may be utilized in developing world contexts.(45)

2. *Report*: IHR-required reporting can be automatically pulled from databases according to logic set by national governments. *[DHIS2]*

3. *Analyze:* Professional links established by international cooperation during eHealth system construction can be used to share best practice for data analysis. All data is aggregated to make analysis and experimentation easy, and new algorithms can be inserted easily. *[ClusterSeer]* At the yearly strategic planning meetings, district or national public health officials have the tools to forecast probabilities of disease outbreaks. The entire health system is geared

towards meeting this forecasted demand for its services.

4. *Investigate:* Improvements in investigation and oversight for the district teams can be pushed into the standardized workflow of district investigators by changing their electronic tools and training materials.

5. *Communicate:* Automatically generated internal reports can be shared with all districts instantly. *[RapidSMS]*

6. *Evaluate*: To improve the system, leaders will the ability to run reports that benchmark the performance of individual or groups of health workers by the quality of data being produced. *[ChildCount+]*

7. *Prepare*: All technical development & support will come from African ICT resources and human capital, so fixing any problem areas will be less expensive and more responsive.

APPENDIX 6: FULL RISK PROFILES

Standards Risk: Standards adopted may not be international standards	**Detailed Scenario**: • Costly reimplementation of Standards • Inability to communicate with regional partners • Inability to import technologies developed in other countries • Lost prestige • Harder to hire staff if standards aren't set		**Underlying Cause**: 1. International standards are slow to be adopted. 2. Current standards may be bad ones—expensive to implement 3. Bad understanding of market in planning process produces bad advice -> people risk, in planning commission
	Probability of event occurring: **Medium** Several healthcare standards exist, and those will probably be the ones used Standards literature has increased 4 fold in past 6 years (37).	*Amount of impact on the strategy or project:* **Small** Cost of implementations: European experience with ICD-10 implementations provides a guide: for countries, having any sort of standard will make the process much easier	*Possible Mitigation:* **High** • Fund engagement with SDOs to promote understanding • Fund larger countries to undertake standards, filtering to smaller countries • Work to establish trust, and then establish consensus by member states on standards • Encourage use of any standards • Create new, more relevant standards in lightweight technology (SMS) & standardized terminology(55)

Sovereignty Risk: International body may set internal policies	**Detailed Scenario**: • Data may increase the risks present in IHR 2005 regulations: release of information a government may not want • Accords may require nations to buy certain systems. • Recommended use of a technology now may lock countries into use of technology in the future (159). • Sharing data may require responses from international bodies. • Privacy of individual patients may be compromised in an international context.		**Underlying Cause**: 1. Lack of trust with the international community, especially around international reporting issues (160) 2. Bad experiences with corporate partners in the past
	Probability of event occurring: **Low** The risk profile is the same as IHR, and implementation is proceeding.	*Amount of impact on the strategy or project:* **Medium** Previous controversies on issues of national sovereignty have been very disruptive (71,	*Possible Mitigation:* **High** • Adopt a strong conflict of interest policy • Adopt a pledge to focus on processes rather than

		72), but the point is less on international coordinationg and more on keeping national systems in control.	technologies • Work in early days to establish trust among members, by giving all nations a seat at the table • Adopt a privacy statement • Support interoperability as a bedrock principle to avoid the lock-in

First Mover Risk: Other countries working first will pave the way for easier implementation later	**Detailed Scenario**: • Being the first-mover in any venture is often risky, especially by players with few resources and industries with high amounts of change (161). • Countries that wait will see higher rates of disease in the short-term, but probably have less expenditure when an investment decision is made (42).		**Underlying Cause**: • Lack of evidence & concrete findings in the industry • Perception of risk of technology • Lack of social norms to invest in ICT for health
	Probability of event occurring: **High** Investments are still lagging and are uneven across the continent; even the leading countries do not have strongly established processes.	*Amount of impact on the strategy or project:* **High** eHealth/eSurveillance needs a to reach a tipping point in the short term or it risks suboptimal implementations, as discussed in the "adoption chasm" section above.	*Possible Mitigation:* **Medium** • Conduct studies of the early adapters & publish case studies to change the perception of risk • Measure the economic advantages from investment in ICT industry • Emphasize other advantages: • Political benefit of being on the cutting edge • Investment from NGOs in national system • Helping citizens become healthier

Complexity Risk: Complex system working together	**Detailed Scenario**: • eHealth systems (especially comprehensive eSurveillance systems) are very complex and require the integration of several types of human and technical systems. Being able to manage and grow this complexity requires a number of organizaitonal capabilities. • If one vital node fails and the system is not well-designed, the entire grid can be put off-line		**Underlying Cause**: • Lack of ICT talent to design systems • Lack of organizaitonal architectures tried and promoted in other countries • Lack of managers to ensure system is well put-together.
	Probability of event occurring: **Medium** A report of national implementations in the EU holds that "the	*Amount of impact on the strategy or project:* **High** A cascading failure can have a huge impact; in a paper-based system, if there is a	*Possible Mitigation:* **Medium** • Measure the modularity in eHealth/eSurveillance Strategies & architectures: count the number of

	complexity of eHealth… has been vastly underestimated" (42). But, if there are change management, proper staff in place and adoption is piece meal, this complexity can be managed.	problem, information can often be gleaned from existing paper forms. If an ICT system goes down, the data can be inaccessible.	recommendations that can be implemented as "building block" systems that don't have dependencies on other systems. • Fund comparative studies to outline the best investments • Promote ideas of "robustness" (to minimize the impact of a failing system) and "minimal dependencies", (minimizing the requirements for a particular unit of the system) • Address HR capacity problems

Constituency Risk: Stakeholders in the country will rebuke the decision to invest in eHealth or eSurveillance	**Detailed Scenario**: • Constituents may be left with a perception that money is wasted, and abandon eHealth or vote out leaders. • Constituents may be left with a perception that investment is for the benefit of the Global North, not their own country, reducing support for eHealth.	**Underlying Cause**: • Lack of awareness of benefits • Lack of Cost Benefit analysis • Lack of social norms across the continent	
	Probability of event occurring: **Low** 1. Quadrupling investment still means very little investment. 2. Failures can be blamed on the international community; success can be claimed by local leaders.	*Amount of impact on the strategy or project:* **High** Lack of belief in stakeholders means lack of political will, which is key to success.	*Possible Mitigation:* **Medium** • Measure public perceptions of eHealth/eSurveillance • Create public relations outreach (a road show for concerned groups, inviting stakeholder groups to educational sessions)

Collaborative Risk: Drive away NGOs or with heavy-handedness	**Detailed Scenario**: • Establishing new regulations—such as national registration for eHealth/eSurveillance or onerous standards protocols—will discourage investments by NGOs in favor of other areas. • Regulations may also drive away private industry partners.	**Underlying Cause**: • Lack of communication with NGOs & private industry • Lack of policy-making expertise	
	Probability of event occurring: **Low** A good, strong policy will improve infrastructure and make NGOs & private partners more likely to	*Amount of impact on the strategy or project:* **Low** NGOs and private partners are important funding sources, but it is unlikely that the large range of them will be driven away;	*Possible Mitigation:* **Medium** • Measure number of NGOs that are supportive of standards • Sensitize NGOs

	invest.	NGOs contintue to make large investments in eHealth even when little success has been seen.	• Explore models for public private partnerships • Create frameworks for cooperation with NGOs & the private sector

Policy Risk: Policy development may be costly	**Detailed Scenario:** • There may be higher priority items on the national agenda, and development or funding for eHealth/eSurveillance is not addressed. • Policy may be set to put onerous restrictions or impair the growth of eHealth/eSurveillance in a country.		**Underlying Cause:** • Lack of government expertise in ICT issues (162) • Lack of awareness in bureaucracy or legislature • Lack of political will
	Probability of event occurring: Low: **Today** Requires political will, but a bad policy is much more costly More attention is being paid to these issues and technology is seen as a panacea, so it is likely to have political support	*Amount of impact on the strategy or project:* **High** If policy is not developed and political will is not strengthened, national eHealth will suffer (better use of policy) (162)	*Possible Mitigation:* **Medium** • Measure perceptions of eHealth/eSurveaillance • Use "road shows" or other publicity/info-sharing techniques to elevate the status of eHealth •

Impact Risks: The investments chosen may not result in a measurable difference to health system outcomes	**Detailed Scenario:** • After all of the systems are in place, costs will continue to stay the same or will increase. • No improvement in disease surveillance metrics will be evident.		**Underlying Cause:** • Lack of knowledge about eHealth research • Lack of good eHealth research
	Probability of event occurring: **High** The lack of evidence in eHealth is pronounced (40); without evidence, programs are just making a best-guess (74).	*Amount of impact on the strategy or project:* **High** eHealth has been victim of many failed programs that have no impact, undermining faith in the industry (163).	*Possible Mitigation:* **High** • Offer more studies that are designed to test the issues faced by governments—which technology to use, what processes to (164) • Continually update best practice modules based on published evidence

Technical Risks: Don't have the talent in place to implement & run system	**Detailed Scenario:** • ICT resources in a country are low • Salaries in the private sector—especially telecomm—are much higher than the government can provide • Training will take too long and be too expensive, or lead to brain drain to the private sector		**Underlying Cause:** • Lack of education • Lack of ICT industry • Lack of infrastructure to get people interested in ICT • Thriving MNOs may squeeze out others

	Probability of event occurring: **High** Evidence shows that ICT in Africa is improving, but significantly behind the rest of the world. MOHes are severely understaffed in ICT (164).	*Amount of impact on the strategy or project:* **High** Programs that rely on international developer talent are expensive and are not maintained (165).	*Possible Mitigation:* **High** • Offer in-person training modules (166). • Create a program of salary support to hire developers • Create strong linkages between Informatics programs in Africa and in the Global North • Offer online supplementation in ICT for health • Offer a corps of experts to supplement the expertise in MOHs

Management Risks: Don't have the talent in place to select system & oversee implementation	**Detailed Scenario**: • There's a cultural divide between public health and ICT that can infect national MOHs • Lack of "Culture of information use" that promotes use of data gathered (from ICT or traditional technologies) to guide public health decisions		**Underlying Cause**: • Lack of education(130) • Cultural divide between public health and ICT that can infect national MOHs • Lack of training of ICT in public health programs
	Probability of event occurring: **High** Understanding the growing link between disease surveillance and ICT is unclear even among technologists; among health managers, it is more so (89).	*Amount of impact on the strategy or project:* **High** Managers in MOHs need fluency in ICT to make proper decisions (94).	*Possible Mitigation:* **High** • Offer workshops and training modules • Work with public health programs to teach more ICT • Offer a corps of experts to supplement the expertise in MOHs

Adaption Risk: Health won't agree to system	**Detailed Scenario**: • While the technology function well, clinicians or public health workers may continue to rely on old processes, making a "Shadow System" (167). • Doctors especially are resistant to changes in work flow (65) .		**Underlying Cause**: • Lack of awareness and skills in ICT by health workers (38) (35) • Lack of solid evidence on the benefit of new systems • Lack of change management skills • Lack of resources for change management and training
	Probability of event occurring: **High** As a guideline, about 40% of costs of new technological systems should go to change management and sensitization (65, 168).	*Amount of impact on the strategy or project:* **High** The technology is only half the battle; without support of health workers, the projects will simply not succeed (19, 65, 169).	*Possible Mitigation:* **High** • Support studies of change management techniques • Provide training modules for healthcare workers in ICT • Provide frameworks & consultants for change management

	This is very rare in systems.	However, surveys show that once familiar, people are in favor (35).	• Establish dialogs about the importance of change management

Maturity Risk: Health systems may not have strong management habits and able to accomplish the goals set by leaders	**Detailed Scenario**: • No use of repeatable frameworks or processes in accomplishing tasks (103), • No accountability • No understanding of the factors that lead to success in new projects (103).		**Underlying Cause**: • Low maturity or capability levels • Implementing systematic public health frameworks such as IHR & IDSR require many of the same processes eHealth/eSurveillance requires. Success in one area will translate to other areas.
	Probability of event occurring: **High** Low organizational maturity characterize the Bleeding Edge. Many ministries currently operate without repeatable processes (114).	*Amount of impact on the strategy or project:* **Medium** Without good governance of projects and ministries, any change will be futile (114).	*Possible Mitigation:* **Medium** • Use countries with success implementing IHR & IDSR as the focus of early adapter support to maximize • Provide consulting services to stakeholders to promote maturity • Develop frameworks

Funding Risk: Money may not be available to meet the necessary budget	**Detailed Scenario**: • eHealth/eSurveillance programs can be large, and therefore costly. • Funding for eHealth in general currently comes from NGOs in large part; consolidation may restrict those funds (164).		**Underlying Cause**: • Lack of appropriate technologies for low-resource environments • Lack of local ICT resources to make costs lower • Lack of awareness & studies: ICT can save money, but cost-benefit analyses are rare. (170)
	Probability of event occurring: **High** Current investments in eHealth are low at only 45¢ per capita (see above)	*Amount of impact on the strategy or project:* **Medium** Systems need money to run, though lower cost protocols could be developed.	*Possible Mitigation:* High • Build public private partnerships to support sustainable models of funding eHealth • Conduct cost benefit analyses of disease surveillance systems • Fund investment for low-cost, open source systems

Overspending Risks: There may be budget overruns	**Detailed Scenario**: • While a reasonable budget may be laid out with the assistance of stakeholders, overruns may be occur because of the complexity of the systems (171). • Spending may be on critical components, so a government would be obligated to keep spending.	**Underlying Cause**: • Uncertainty surrounding the cost of maintenance of these systems(170) • Long term maintenance is required. (172)

	Probability of event occurring: **Medium** In the beginning, costs are harder to measure, but as more countries adopt eHealth/eSurveillance systems, budgets will be easier to form.	*Amount of impact on the strategy or project:* **High** Systems can turn into black holes of expenditure (170).	*Possible Mitigation:* **High** • Conduct case studies on the Early Adapters to outline solid spending estimates • Organize a spending pool among countries to insure against overruns (148) • Provide budget control consulting services and real-time measurement of expenditures and variance

Infrastructure Risk: Electrical and communication network may be unreliable	**Detailed Scenario**: • The basic infrastructure of many African countries prevents universal scale-up of systems		**Underlying Cause**: • Lack of development
	Probability of event occurring: **High** Many projects in eHealth have failed at scale-up because of a lack of infrastructure.	*Amount of impact on the strategy or project:* **High** Computers and servers cannot run without power.	*Possible Mitigation:* **Low** • Develop technologies for low-resourced environments • Develop Public-Private Partnerships for infrastructure development

Sustainability Risk: Projects may be expensive or difficult to maintain	**Detailed Scenario**: • Technological Sustainability: Technology may go out of favor, meaning it is harder to find people to work with it • Financial Sustainability over the long term may be expensive		**Underlying Cause**: • Pace of technological change Lack of ICT resources
	Probability of event occurring: **Medium** Maintenance is very expensive and not well provisioned for (172). Telemedicine networks have been sustainable (164).	*Amount of impact on the strategy or project:* **High** Without maintenance, the project will fail over the long term.	*Possible Mitigation:* **Low** • Sustainability is a difficult problem without many answers currently.

Disaster Risk: Projects may not be prepared to deal with contingencies	**Detailed Scenario**: • Force Majeure Risks: Floods, power surges, political strife may lead to data loss		**Underlying Cause**: • Lack of infrastructure
	Probability of event occurring: **Low**	*Amount of impact on the strategy or project:* **Medium**	*Possible Mitigation:* **High**

Scaling Risk: Projects may not be able to grow in Phase 2, Phase 3, etc	**Detailed Scenario**: • May cost too much on a per-person basis • Staff expertise		**Underlying Cause**:
	Probability of event occurring: **Low** Governments can use some existing frameworks to avoid un-scalable designs (123).	*Amount of impact on the strategy or project:* **High**	*Possible Mitigation:* **Medium**

Customization Risk: Technology may not fit local needs	**Detailed Scenario**: • Technology may not fit local needs		**Underlying Cause**:
	Probability of event occurring: **Low**	*Amount of impact on the strategy or project:* **High**	*Possible Mitigation:* **Low**

Appendix 7: Sector Analysis on Enabling Organizations

Six types of organizations were identified. An overview of each type is presented.

Non-governmental Organizations

Estimate of total number	28 programs are counted that serve an "enabling" role in Africa
Total WMR Score	817
Estimate biggest	The mHealth Alliance, Rockefeller Foundation, CapacityPlus program, and African Population & Health Research Center programs are the largest
Where the money is spent	Research organizations, Communities of practice and ICT training are the biggest activities
Trends in activities of the industry:	There is much more focus on systems improvement rather than funding individual efforts, so this category is bound to grow.

Foreign Aid Agencies

Estimate of total number	8 found in databases
Total WMR Score	724
Estimate biggest	The US Defense Department/DTRA has the largest amount world-wide grants; USAID has a number of heavily funded projects.
Where the money is spent	Funding, software development & ICT training
Trends in activities of the industry:	• The European Space Agency is a nontraditional funder; it is conducting studies on eHealth and has a long-term plan to use satellite technology to improve health in Sub-Saharan Africa. • USAID has an out-sided influence in this space: their support of k4Health, MeasureDHS and Capacity Plus all touch on issues discussed here. • Scandinavian countries—Sweden and Norway—have a higher interest in eHealth.

International Agencies

Estimate of total number	21 programs are counted that touch on Africa (World Bank, WHO, African Union, East African Community, ITU, EU, UNHCR, UN Foundation, African Sub Regional Coordinating Networks; PAHO also has resources);
Total WMR Score	600
Estimate biggest	World Bank funds the most; WHO Health Metrics Network likely has the biggest staff.
Where the money is spent	Top 5 activities are: Funding, Government Networker, Research organizations, Resource Libraries, Communities of practice & networkers
Trends in activities of the industry:	More participation by sub-regional African networks in East Africa, Central Africa and Southern Africa

The WHO has 10 active programs that range the Global Observatory on eHealth, which conducts research on the state of eHealth in member states, to the Health Metrics Network, which improves surveillance systems to the Global Health Workforce Alliance, which training health workers in ICT technology. Also of note is that since 2004, the WHO established 7 programs in eHealth that no longer function.

Professional Societies

Estimate of total number	7 found
Total WMR Score	242
Estimate biggest	International Society for Infectious Disease, HL7 & Joint Initiative Council both have large membership
Where the money is spent	Mostly standards; some coordination
Trends in activities of the industry:	• The International Society for Infectious Disease runs PROMed, which is a very important e-mail based worldwide disease notification system. • Joint Initiative Council (JIC), Continua Alliance, ISO technical Committee 215 (ISO tC 215) and Health Level Seven (HL7) International all try to set standards for the eHealth industry. However, membership is usually very expensive, so they generally do not have much African representation. HL7 has recently announced they will be making their standards open source.

Private Companies & Vendors

Estimate of total number	5 found in databases; but there are many global health consulting firms.
Total WMR Score	131
Estimate biggest	Voxiva
Where the money is spent	In research & academic partnerships
Trends in activities of the industry:	• **CSR**: Orange Telco has an active CSR program. Other Telcos do as well. • **Entrepreneurship**: iHub Nairobi is an incubator for startups; some of them touch on health, though they are quite small. • **Social Enterprises**: There are not many, although DataDyne is a good example—it charges just corporate customers for its Magpi/EpiSurveyor software and provides the rest of the ecosystem free use. • **Consulting Firms**: There are number of firms willing to assist implementers. • **Venders**: IBM & Cisco have strong presence in eHealth, though their projects are more likely to be one-offs, as their systems are generally proprietary. Voxiva is completely eHealth focused. There have been other disease/mapping startups (see Veratect Corporation), but they were not able to turn a profit.

Academic Centers

Estimate of total number	28 found in databases; smaller in average size
Total WMR Score	65
Estimate biggest	In coordination: Johns Hopkins (mHealth); University of Washington; University of KwaZulu Natal; University of Indiana; Thailand university & King Faisal; Harvard University has a Global Health Delivery project active in mHealth.
Where the money is spent	In research & academic partnerships
Trends in activities of the industry:	• It is the partnerships between academic programs that have the most activity; Indiana University/ and Moi Institute are a good example. • Research programs are focused on implementation, and the projects examined are generally smaller. This presents a bias in the literature, because larger NGOs conduct fewer studies.

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