Technology for healthcare in humanitarian projects

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Abstract
This paper describes international humanitarian efforts for the deployment of technology in healthcare centers in developing countries. The IEEE Humanitarian Technology Challenge (http://www.ieeehtc.org) develops and implement technological solutions for the provision of reliable electricity, data connectivity of rural district health offices, and identifying individuals and linking them to their medical records. The focus is set on the Individual ID tied to Health Records because the authors are involved in this specific challenge. The paper will report the proceedings for providing a comprehensive system that will define public health in villages, allowing for trauma and emergency as well as disease response, control and studies, clinical healthcare, disease surveillance and prevention, and health vaccination. Furthermore, the paper describes the economics of healthcare in developing countries and how this affects the implementation of technologies.

1. Introduction
If developed countries deal nowadays with equity in health and healthcare, most developing, less developed or low-income countries face other types of difficulties regarding health services. In these countries, far too many people have to deal with inadequate nighttime lighting or inadequate communication due to lack of reliable electricity; too many healthcare providers are forced to treat patients without having access to databases of past results and new research trends and a large number of people die from easily treatable diseases because of inadequate health records.

Health has always been a central concern for individuals, groups, communities or the global society and the importance of health cuts across individual of all ages and across all societies. In the 20th century we witnessed an extraordinary progress on health, but progress in health is fragile (The Global Agenda, 2009).

Understanding the challenges of health and of the social response to health problems is difficult. Therefore, the global community tried to set a number of critical goals for development, the Millennium Development Goals. Three of these are health-related: MDG4 – reducing child mortality, MDG5 – reducing maternal mortality and MDG6 – reducing major diseases (HIV/AIDS, tuberculosis, malaria). These MDGs have generated endless policy discussions and focus in many settings.

Although real progress has been made, the agenda for global health is much broader than the MDGs. Therefore, worldwide, there is a lack of coherence in global health governance, which leads to the impossibility of effective representation throughout the globe. The institutional efficiency, mandates, activities, authority and even resources allocated for the global health initiatives show clearly that there is no agreed plan or strategic vision to tackle the major health problems across the world. And given the diversity of the determinants that make up the healthcare worldwide, only concerted leadership on health issues within the public health sector would help solving these problems (Lee et al., 2009).

Global healthcare is indeed missing a list of guidelines and a comprehensive identification of challenges to be taken into consideration for developing countries. This is why the Humanitarian Technology Challenge (HTC) project was created. Its main scope is to identify the major challenges brought by lack of adequate healthcare provision in developing countries. This initiative was developed by technologists as well as humanitarians, non-profit organizations, students, government employees and others that come together to identify, work and solve some of the worlds most pressing humanitarian challenges. HTC is a unique concept, developed in such a way that it is open-source and collaborative at the same time.

2. HTC challenges
The Humanitarian Technology Challenge is a joint initiative of the IEEE, the world’s largest trade association of technical professionals, the IEEE Foundation, the United Nations Foundation and Vodafone Foundation Partnership.
The project enables technologists to work with humanitarian aid professionals, contributing time and expertise, to solve three major challenges:

- **Reliable electricity** – Everywhere in the world, reliable electric power is key to economic development and medical care. In developing countries, electricity is fundamental for many essential services, including those that increase income and benefit rural areas. Major uses for electrical power include: agriculture, water purification and distribution, healthcare, education, commercial and industry applications, bidirectional communications, standard of living. Energy planning policies in developing countries must be effective and sustainable in order to stimulate investment in power-plant modernization and in rational energy usage. Developing countries can count on a variety of potential electrical energy sources, including solar, hydroelectric, people-powered, fossil-fueled, geothermal and eolian. Cost remains a major factor in obtaining affordable power sources. But power sources are frequently undersized, battery and charging systems are often misused and therefore prone to failure, and there is a lack of standard and easy to use interfaces for switching among various power sources based on demand and capacity.

- **Data connectivity of rural district health offices** – In many developing countries, healthcare is provided by rural district health offices, which may not have data connection to other health centers in the area. Being able to exchange data between central and remote field health facilities/offices is crucial. Some of the reasons for establishing this connectivity are as follows: interaction among healthcare professional; retrieval of patients’ medical records; transferring medical records to a central database; providing a link for remote diagnosis/treatment; consultation with psychiatrists education/training for staff; alerting offices about emergencies and outbreaks.

- **Individual ID tied to health records** – Consistent availability of patient medical records. Important for treatment of migrant patients and those with long-term diseases.

Not long ago, the use of Electronic Health Records (EHRs) in developing nations was thought to be unrealistic. What projects existed used either expensive commercial software in large organizations or user-developed software for specialized purposes, such as to manage a specific disease. Since then, several successful EHR systems have been implemented in developing countries, due in no small part to the increase in the availability of information technology in these areas. These factors, along with recognition of the benefits of EHRs in improving quality of care in developed countries, have created a broad interest in the use of such systems in the management of diseases such as HIV and drug-resistant Tuberculosis (TB). There are examples of successful implementations of such systems, such as the AMPATH project in Western Kenya, the PIH (Partners in Health) projects in Peru, Haiti, and Rwanda, the Baobab Health systems projects in Malawi, and the CIDRZ (Center for Infectious Disease Research in Zambia) project (eHealth 2008).

**Figure 1:** Summary of the information requirements

![Diagram of information requirements](image)


In many places, some kind of legacy, paper-based EHR system will already be in place. But throwing it out and replacing it with an electronic system may not be so simple, or appropriate. It can be difficult to shift the concerned parties in lockstep from the paper-based system they know to an electronic system you know. More
likely, any new system will have to be a hybrid of electronic and paper-based tools. This adds to the difficulty of designing a system because the records will have to work in both a paper and an electronic world. Simply scanning paper into electronic form does not address the real issues, nor does it correct errors that may have been embedded earlier.

An accompanying problem is the lack, in many developing countries, of a system for accurately obtaining unique identification of every person for whom a health record is created. Identifying each and every individual accurately is not only a major problem at healthcare facilities in developing countries, but a most difficult task. Obviously, knowing who is who avoids potentially harmful, even deadly, errors, and allows for continuity of care and sound management of drug use. It also helps eliminate unnecessary procedures and reduce fraud, thereby lowering costs and improving a system’s efficiency.

Accurate individual identification is also necessary if a facility is to contribute to the epidemiological statistics gathered by the national government. If you don’t know who you’ve been treating, the prevalence of illness—such as malaria, TB, or HIV/AIDS—cannot be counted accurately. Measuring the baseline health of a country, and any improvements in health, is difficult if not impossible.

Name confusion leading to mistaken identity is a special problem in communities where most people’s names are not unique, as you may find in a developing country. This is especially so within smaller settings such as tribes and rural and remote communities. In extreme cases, individuals may have no useful identity to offer at all; their culture or literacy may prevent them from accurately reciting their identities with consistency. Tying records to individuals without a stable means of identification (name, address, etc.) can be a great problem.

2.1. Subchallenges

2.1.1. Subchallenge 1 - Individual ID

In many developing countries, there is no method for accurately and uniquely identifying every person who presents at a healthcare facility needing or requesting care. Obviously, knowing “who is who” helps avoid potentially harmful, even deadly, errors and allows for continuity and sound management of an individual’s care. It can also help eliminate unnecessary procedures and reduce fraud, as well as contribute to the epidemiological information for the region.

The Individual ID Challenge is to design a system for healthcare facilities in developing countries that correctly identifies individuals so that accurate medical records (paper or electronic) can be created, stored, and located the next time that individual presents at the same or other healthcare facility. Such a system should answer the following questions:

• Is this person who he/she claims to be?
• Has this person accessed health services previously here or elsewhere in the system?
• What services has this person received?
• Is this person a member of a household or in a relationship that could have some effect on the condition, such as HIV/AIDS, that brought him/her into the facility for care?

2.1.2. Subchallenge 2 - Health Records

Longitudinal collection of health information generated by visits of an individual to a medical facility provides the knowledge needed to enhance the quality, safety and efficiency of that individual’s health care. These records, which can include patient demographics, problems, diagnoses, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. There are many significant issues involved in designing and developing a health records system, but the value of a system depends upon, first, accurate identification of the individual to whom the information belongs and second, the ability to link records gathered over time (and perhaps at more than one facility) to that individual in order to show a complete history of that person’s encounters with the health care system, regardless of where or when those encounters occurred.

The Health Records Challenge is to design mechanisms by which health records of identifiable individuals can be linked within a facility or group of facilities effectively and efficiently in developing countries with little or no technological infrastructure. The challenge is not to design a health record system, but rather to determine how technology can support the sharing of an individual’s information over time and distance. Security and protection of personal information are critical elements in addressing this challenge.

2.2. Short-term challenges

Designing and implementing a reliable individual ID system could be a worthwhile short-term project. But this cannot be done in a vacuum: it must be tied into whatever overall health record system the country may already have, even if it’s only a small pilot project, and the overall health strategy of the country. This last point is
particularly critical; the design of the system must reflect the intended use, whether it be a public health/disease surveillance system or one for assuring the continuity of care for individuals.

Any individual ID system must answer the following questions:
- Is this person who he/she claims to be?
- Has this person accessed health services previously here or elsewhere in the system?
- What services has this person received?
- Is this person a member of a household or in a relationship that could have some effect on the condition, such as HIV/AIDS, that brought him/her in for healthcare?
- In preparation for developing an individual ID system, it will be helpful to:
- Make an inventory of ID and health records methods already in use in your target country, including those implemented by NGOs and other entities not within the country’s healthcare system that could be applicable.
- List the identity needs: short term for individual ID, disease and disaster control and medical statistics, or long term for keeping healthcare records.
- Identify the problems of melding an individual’s ID with perhaps a national or other ID that your country may already have.
- Identify how you might provide ID for people in remote locations or for populations with literacy issues.
- Find out if your country has any regional variations in the preference for one means of identity or another.
- Find out if there already are ID methods in your country for such things as money transfer or micro-banking, and if there are any regional preferences for one system over another.
- Calculate the cost and resources needed to provide accurate individual identification and the tradeoffs among different options.
- Identify the importance of various disease treatments in your areas, and the need to accurately identify individuals needing such treatment. Errors in some cases could be fatal; at the least, they represent a waste of time and resources.
- Now you may be ready to develop a plan for identifying individuals using a mix of technologies.

2.3. Longer-term challenge

EHRs allow for the longitudinal collection of health information generated by any number of visits of an individual to a health facility. They provide the knowledge needed to enhance the quality, safety and efficiency of health care (Task Force to Study Electronic Health Records, 2007). These records, which can include demographics, problems, diagnoses, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports, are legal records that must be accessed securely by authorized parties.

However, implementing an electronic health record system is a long-term project, and can take many years, even in countries without the infrastructure challenges facing developing countries. You should design an intelligent data model for multiple sites, and you must also consider what functions will be needed in the future. Otherwise, it will be difficult to scale up a flat-file data model to a larger relational-model clinical system or one that can be deployed to other sites.

Again, accurate individual (and provider) identification is the backbone of an effective EHR system, whether manual or electronic. Problems abound, though, and may include such issues as the lack of standard terminology in the country, including how clinical data is to be entered (Electronic health records: manual for developing countries, 2006). Another concern is a staff lacking appropriate training. This could affect the quality of data entries and the information in general. For example, staff members may not know how to classify diseases. The staff could also be resistant to computer technology, in part because they’re not computer literate. They could also be concerned that information will not be available when they request it. And everyone healthcare professionals, individuals and the general community is likely to be concerned about individual privacy. It is essential to involve the healthcare personnel and facility administrators with your project as early as possible.

In remote areas, the system for storing and retrieving EHRs should be as simple as possible. Even so, developing such a system is likely to be expensive, considering the cost and complexity of acquiring computers and computer systems, as well as the need to maintain and upgrade them. Computer installations also have an environmental impact (Scott, 2009) and involve practical implementation issues such as the quality of the space needed to house the computers, the supply of electricity and the electrical wiring. (Note that the electricity supply relates directly to the Reliable Electricity Challenge.)

Once you’ve recognized the potential problems, you can move on to:
• Identify the key benefits of migrating to an EHR system with respect to local and global disease control and management, and the long- and short-term healthcare benefits.
• Identify best practices, along with the problems (such as data migration from legacy systems (Scott, 2007)), for implementing data storage and retrieval of EHRs in remote locations. (Note: this relates to the IEEE Data Connectivity Challenge.)
• Identify regional variations in your country’s approach to EHRs, including cultural, regulatory and political constraints.
• Identify potential misuses and gaps in handling EHRs.
• Identify examples of systems for storing and retrieving data that could be applied in your area, and how your community could benefit.

Figure 2: Levels of feedback in healthcare delivery

Source: Singleton, 2009

2.4. Applicable technologies
A number of technologies are applicable to an individual ID system, as well as to storing and retrieving EHRs. Possibilities include a combination of biometrics and human-readable alphanumeric characters such as a name and a number, barcodes, RFID tags. Biometric techniques can be chosen from among fingerprint systems and facial, voice, and iris recognition. A generic biometrics system captures, usually in real-time, the characteristics of an individual, then processes and stores the record in a database. Another possibility is making use of the SIM cards many individuals have in their cell phones to use a phone as a platform for validating the person’s identity (although shared use of cell phones may compromise this approach due to confidentiality issues).

One example of an architecture already in place for verifying an individual’s ID is a system in Crete (Lees et al., 2000). The Lees paper describes a set of middleware services that facilitate access to the island’s telecommunications infrastructure and integrates electronic records from multiple systems. The middleware provides three kinds of services. One is a directory that identifies individuals based on commonly used information, and includes such information as the addresses of facilities in the system. The system also provides security for certification of users and encryption of the records and a glossary of terms that can be helpful for translating among different standards. Unfortunately, the approach to correlating individual ID relies
on information such as name and address, which is unsatisfactory for this challenge. But the system’s architecture could be used with other techniques such as biometrics.

Above all else, an EHR system for a remote area should be simple (Task Force to Study Electronic Health Records, 2007) and have a user interface that adapts to the local culture and language(s). It will be of great help if you consider systems that have already been successfully deployed in challenging environments, especially if you can find systems with ample evaluation data. A summary of recent efforts to create EHR systems in developing countries is found in (Fraser et al., 2005). This paper discusses projects in Kenya, Peru, Haiti, Uganda, Malawi and Brazil. It describes system and network requirements, as well as organizational, user and security concerns. It includes basic cost estimates for various kinds of systems, along with an extensive bibliography. Open source systems and initiatives already under way such as OpenMRS or CHITS (Seebregts et al., 2007; Marcelo, 2009) could lead to reliable technology at reduced costs.

Any technology platform you deploy must be practical for the intended environment and its end-users. It must integrate hardware, software, instrumentation and communications efficiently and cost-effectively. Such a platform must also complement and integrate with existing or future hospital, laboratory, healthcare and clinical systems, making adherence to recognized standards important. Several technologies may be deployed in a single environment; some may be available commercially (Alvin Systems, 2005) or from nonprofits (OLPC Health Project, 2010), while others could be based on proposed new approaches (Zhang et al., 2007).

Availability and cost effectiveness are the two key issues to be considered at this stage, along with standards and the country’s culture. An example of a low-cost computer-based approach is the One Laptop per Child (OLPC Health Project, 2010) non-profit project (OLPC, 2009), and its target $100 laptop (this particular project may not be applicable to our needs). At the same time, wireless technologies such as cellular communications and smart phones are becoming more widely available, and there is at least one initiative using them for remote diagnoses and data collection (Vital Wave Consulting, 2009). This technology is power efficient, programmable, and generally reliable in terms of devices and communication connectivity.

Of course, introducing information systems to remote sites with no communications facilities may prove of little use. Wireless communications from reliable local service providers can facilitate telemedicine consultations and lead to fewer patient transfers from a remote to a better-staffed facility. It is vital to set realistic targets for what technologies can be deployed, and what level of deployment is possible. The low level of adoption of EHRs in developed countries, for example, indicates that change management, policy, and strategy issues are the primary problems, rather than technology (Overcoming barriers to electronic health record adoption, 2006; Jha et al., 2009, Khoja et al., 2009). Training and managing healthcare staffs to deal with technological systems are significant issues (Working with humanitarian organizations 2009). Adopting electronic records without significant changes in the way doctors and medical facilities operate will not result in improved quality of care or lower costs. You must make sure your system will support new work processes and true interoperability.

### 3. The economics of healthcare in developing countries

Once the HTC solutions are developed, a viable business model is needed to define and test the solution’s components, customers, distribution, marketing and operational plans. This model is supposed to lead into the development of a complete business case. Therefore, it is crucial for the HTC project to define and use the concept of health economics for developing countries.

#### 3.1. Health economics

Health economics can be defined as the application of theory, concepts and techniques of health economics to the health sector (Mills et al., 1988). As good health became a major determinant of economic growth and a component of the human development indexes in the last twenty years, health economics developed as a sub-discipline of economics and is touching many of the main theoretical areas of this discipline. Amongst the standard categories of economic theory it touches we can find topics like demand, consumer choice, production technology, supply, markets, industrial organization, economics of information incentive structure and social welfare (Mwabu, 2007).

Although all these theoretical aspects can provide an interesting insight into the field of health economics, none of them can offer adequate understanding of healthcare on their own (Culyer et al. et al., 2000). Therefore, we present in figure 3 a basic framework for understanding how the different theoretical aspect of economics interlace in order to provide a reasonable view of healthcare nowadays:
A: The main question concerning health economics is what exactly influences the health of the people coming from a certain region, community or grouping. The contribution of education, income levels, consumption patterns, environment is crucial in this aspect.

B: The value of health for the consumer/patient or end-user is another aspect in analyzing the economics of healthcare. This value is statistically different in developed and developing countries. The items we need to include in our analysis are: externalities, the utility for the end-user, health status indexes. It is very important to quantify health and its value for the patient (Oliver, 2003).

Figure 3: The framework of health economic

Source: Adapted from Centre for Health Economics, University of York; Mills, 1988.

C: The factors that influence the demand for health services are determined by both A and B, barriers to access (prices, distance, psychological barriers etc.), agency relationship or the behavior of health providers, the need for health services and the social welfare of the region.

D: The supply of healthcare is determined by the associated costs, the available production technology, the industrial organization and the incentives that result from these.

E: The correlation between the supply and the demand for health services in terms of money, time, rationing systems and consumer choice is included in the markets response.

F: Micro-economic evaluation is done by the end-user of healthcare services and deals with the costs, benefits and all the ratios resulting from these.
G: The macroeconomic evaluation is actually an evaluation at the level of the whole system and analyzes the effects of different ways of financing and organizing the health sector. In this respect, equity and efficiency criteria are of equal importance as the comparison of performance at a local, regional or international level.

H: Budgeting and planning target the maximization of the achievements and their efficiency. Norms and regulations as well as the incentives structure are created here.

As we can see, health economics is concerned with the analysis of costs, benefits, management and results of healthcare. Health economics draws its inspiration from a number of disciplines such as finance, insurance, econometrics, labor economics, public finance, development studies (Culyer et al., 2000).

The research related to health economics has been surprisingly applied to the healthcare in developed countries. Considering the distinction between positive and normative economics (‘what is’ vs. ‘what it should be’) we can conclude that healthcare economics in developing countries is mainly linked to the normative side of research (Oliver, 2002).

The principles of health economics that apply to developing countries are the same as the core principles of the main discipline (Mwaba, 2007). Depending on the environment, there might be a need of adapting these principles to institutional conditions (or their absence) of developing economies. These can be (North, 1990; Williamson, 2000):
- Formal: regulatory and legal structures, property rights, insurance laws, constitutions;
- Informal: customs, traditions, social values, and beliefs;
- Social networks and civil society organizations.

All of these institutions are country- and time- specific. Therefore, any economic interpretation or intervention, even though based on the same theory, can differ substantially across geographic position and time span (Oliver et al., 2005). The intervention is based on having the same key factors and institutions and in conclusion the same model cannot be applied throughout. This is the main reason why healthcare research is not directed towards developing countries. The best way of dealing with healthcare modeling in these countries is to have a general framework that can be easily adapted to the internal/regional context. This framework will result in the development of a business model in three steps:
- Value proposition – this will target the segments of the market, the costumers and will deal with marketing and operational strategies.
- Business model feasibility – technical description of the solutions and the feasibility from a managerial point of view.
- Complete business case.

The HTC proposition is to follow such a framework and try to achieve a business model in emerging markets.

**Figure 4: Business model development process in context**

*Source: Business Modelling Workbook, HTC, June 2009*
Vital Wave Consulting designed this Business Modeling Workbook (HTC, 2009) to assist in the creation of a viable business model for Humanitarian Technology Challenge projects focused on emerging markets. The Workbook focuses on defining the Value Proposition of the proposed solution, which is the first step in the process of building a complete business model (Figure 4). After this workbook is completed, the Feasibility of the business model can be tested according to the steps outlined below. For reference, an outline of the complete business case is provided.

The value proposition is the sum of the total benefits (or utility) of the solution and is a central component of the business model. The five-step process to building successful value propositions, which is outlined in figure B and detailed throughout this Workbook, provides a framework for identifying and understanding the customer and purchaser needs. It also highlights the importance of articulating how the solution can meet those needs.

**Figure 5**: Five-step process to building successful value propositions

<table>
<thead>
<tr>
<th>Step One: Identify target segments and customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the target customer segment and who are the key customers?</td>
</tr>
<tr>
<td>Economic Buyer’s name and/or profile?</td>
</tr>
<tr>
<td>End User’s name and/or profile?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step Two: Identify pain points: Day in the life of a customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze the target end user’s current situation by being the customer for a day, an hour, a month, etc. Analyze their pain points. Pay particular attention to processes, activities, and daily experiences and imagine what could be improved.</td>
</tr>
<tr>
<td>Describe the experience.</td>
</tr>
<tr>
<td>What are the pain points?</td>
</tr>
<tr>
<td>How could this be improved?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step Three: Define the compelling value proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define the “elevator pitch.” If you only had 11 seconds to describe the value of the solution to each of the following, what would you say?</td>
</tr>
<tr>
<td>Economic Buyer?</td>
</tr>
<tr>
<td>End User?</td>
</tr>
<tr>
<td>A potential partner or donor?</td>
</tr>
<tr>
<td>Define the value proposition in greater detail.</td>
</tr>
<tr>
<td>Economic Buyer</td>
</tr>
<tr>
<td>What are the best perceived alternatives to the solution? (This can include non-consumption)</td>
</tr>
<tr>
<td>What is the target price of the alternatives to the solution</td>
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<tr>
<td>Step Four: Define the distribution system, marketing and operational strategy</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Distribution System</strong></td>
</tr>
<tr>
<td>How will the solution be delivered to the economic buyer and the end user? What channels will be employed?</td>
</tr>
<tr>
<td>List all Assumptions</td>
</tr>
<tr>
<td><strong>Marketing Strategy</strong></td>
</tr>
<tr>
<td>What is the marketing and sales strategy?</td>
</tr>
<tr>
<td><strong>Operational Strategy</strong></td>
</tr>
<tr>
<td>What is the operational strategy?</td>
</tr>
<tr>
<td>What distribution channels?</td>
</tr>
<tr>
<td>What support and maintenance?</td>
</tr>
<tr>
<td>What suppliers are needed?</td>
</tr>
<tr>
<td>List all assumptions</td>
</tr>
</tbody>
</table>

| Step Five: Validate the value proposition and distribution system |
|---|---|
| What is the plan to validate the value proposition and distribution system? (e.g., primary research, focus groups, email campaigns, secondary research to ensure that your assumptions are correct) | |
| List all assumptions to be validated: | |

Source: HTC, 2009

The purpose of the *Business Model Feasibility* is to determine the validity of all the components of the proposed business model. This Appendix describes how to identify a solution's strengths and weaknesses and identify key drivers of the business model, set pricing goals and determine assumptions.

**Table 1: Business model feasibility**

<table>
<thead>
<tr>
<th>Solution Technical Description and Management Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the product specifications?</td>
</tr>
<tr>
<td>Explore the following Critical Success Factors:</td>
</tr>
<tr>
<td>Technical maturity/reliability</td>
</tr>
<tr>
<td>Level of disruption in target market</td>
</tr>
<tr>
<td>Technology (components) availability in-country</td>
</tr>
<tr>
<td>Potential 3\textsuperscript{rd} party partners, vendors, and suppliers (local and regional)</td>
</tr>
</tbody>
</table>

10
| Overall technical solution Cost of Goods Sold (COGS) compared to the price point |
| Environmental considerations, ruggedization, cultural context |
| Design plan for localization |
| List all assumptions |

**Business Model Feasibility**

- Explain the qualitative description of operational and financial flows

**Explore the following Critical Success Factors:**
- Distribution channels and retail/channel infrastructure (extent or need to create?)
- Manufacturing/supply chain costs/risks
- Transportation costs in country
- Initial support and maintenance plan
- Initial fulfillment and supplies plan
- Production capability and scalability
- Access to partners (NGOs, government at local, regional level)
- Pricing plan
- Cost considerations
- Creative financing (microfinance or communal purchasing)
- Legal/import restrictions and tariffs
- Length of sales cycle
- Promotion
- Initial Go-to-Market (GTM) plan
- Cannibalization issues?
- List all assumptions

**Business Model Feasibility – S.W.O.T. Analysis**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaknesses</td>
<td>Threats</td>
</tr>
</tbody>
</table>

**Source:** HTC, 2009

The business case outline provides an overview of all necessary details and issues to consider when developing a complete business case. An executive summary should be approximately one paragraph and the remaining detailed analysis should be 10-15 pages in length. This business model feeds into the development of a complete business case, which layers on additional plans and market intelligence in a comprehensive document that is required to justify solution commercialization and secure funding and other commitments. The components of a full business case are:

1. Situation Analysis
   1.1. Establish the need: What is the market pain point?
2. Market Characteristics and Opportunity
   2.1. Market trends
3. Customer data: Who are the customers?
   (Description and profile)
2.2. Quantitative market sizing by segment/country
2.3. Gross market and addressable market size
2.3.1. Factors affecting the addressability of the gross market
2.4. Market growth rate and drivers of growth
2.5. Market segmentation
2.6. Political environment
2.6.1. Trade issues, right to do business, etc.
2.7. Competitive landscape
3. Industry Analysis
4. Solution Description
4.1. Functional description of solution: How does it address the pain points?
4.2. Components (hardware, software, services)
4.2.1. Design plan for localization
4.3. Solution relevancy: Why will the solution appeal to target buyers and end users?
4.3.1. Economic Buyers – compelling reason to buy
4.3.2. End Users – compelling reason to buy
4.3.3. Differentiation
4.3.4. Future evolution of solution
4.3.4.1. Vintage chart
4.3.5. Current solution status
4.4. Competitor analysis
4.5. Strategic control points (or barriers to competitors succeeding with an equivalent solution)
4.6. Reasons to exit project
5. Long-term Growth Potential
5.1. Long-term strategic position
5.2. Geographic expansion potential
5.3. Future offerings (features, price points, channels)
5.4. Expansion to adjacent markets/segments
6. Functional Strategies & Partnerships
6.1. Go-to-market strategy
6.1.1. Promotional messaging and awareness generation
6.1.2. Reseller partners
6.1.3. Financing/payment methods
6.1.4. Region-by-region engagement
6.1.5. Reporting
6.1.6. Quota/incentives
6.1.7. Pricing and cost modeling by country
6.1.8. Rollout plan by country
6.1.8.1. Short-term launch strategy
6.1.8.1.1. First target geography
6.1.8.1.2. Identity of early adopters
6.1.8.1.3. Buying process
6.1.8.1.4. Channel preferences
6.1.8.1.5. Timetable and critical dependencies
6.1.8.2. Long-term launch strategy and growth plan
6.2. Operations strategy
6.2.1. Manufacturing and assembly
6.2.2. Supply chain/procurement
6.2.3. Distribution channel
6.2.4. Partners
6.2.5. Customer support and maintenance
7. Financials
7.1. Bottom-up contribution margin statement and Net Present Value
7.2. Volume assumptions
7.3. Pricing assumptions: What is the logic behind the pricing strategy?
7.4. COGS assumptions
7.5. Product development, sales and marketing
7.6. Sensitivity analysis
7.7. Forecasting by quarter, by country
7.8. Overall investment requirements
8. Stakeholders
8.1. Key stakeholders
8.2. Potential partners
8.3. Social impact
8.4. Environmental impact and sustainability
9. Assumptions
9.1. Assessment of risks
9.2. Market size
9.3. Competitors
9.4. The solution
9.5. Time to market
9.6. Financials
10. Key Dependencies
11. Next Steps
11.1. Decision tree (staff decisions; Regional/country buy-in)
11.2. Timeline
11.3. Project plan

4. Discussions
Delivery of quality health care depends in part on providers and facilities knowing beyond doubt just who the patient is. Failure to do so encumbers the provision of healthcare at the very least; at the worst, it can prove fatal (in the US alone, it is estimated that preventable medical errors cause nearly 50,000 deaths each year). While
patient identification errors have sparked safety initiatives worldwide, these typically focus on large healthcare institutions and are not suitable for the delivery of care in the developing world. Fundamental to this challenge, therefore, is accurate patient identification at the first point in the system - the primary care facility. The goal of the Individual ID and Health Records Challenge is to develop ways for providing consistent and reliable access to an individual’s health record. A working group is volunteering their time to develop a solution that can be used in locations where an individual’s name may not be unique, identifying information may not be accurate, records may be used by third parties for reasons other than healthcare, or illiteracy may prevent individuals from accurately reporting their identities. The volunteers propose to provide a comprehensive system that will define public health in villages, allowing for trauma and emergency as well as disease response, control and studies, clinical healthcare, disease surveillance and prevention, and health vaccination.

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6. References


