Selecting and Implementing the Right Information and Communications Technologies: A Toolkit for Decision-makers

# About this toolkit

This guide aims to provide public health managers with knowledge required for the implementation of information and communication technologies (ICT). It is not an exhaustive technical guide to information systems implementation, nor does it address the strategic questions around a wider e-Health vision. Instead, it draws on lessons learned in Project Optimize[[1]](#endnote-2) and others to propose a simple step-by-step process. Going through this process can help decision-makers:

* Select the systems that fit the needs and context of their health system.
* Seek the right expertise to implement systems that scale beyond pilot projects.

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| ★ Eight steps |
| 1. [Define outcomes](#_Step_1:_). How will a better information system benefit you? How should you define the scope? How will you measure success?
2. [Form your team](#_Step_6:_). What skills and roles are required to bring your project to a satisfying outcome?
3. [Define what your system needs to do](#_Step_3:_Assess). How can you define your requirements for the system?
4. [Find the right solution](#_Step_4:_). Should you buy or build? Do you select open-source or proprietary systems? How do you evaluate several alternatives and select the best one?
5. [Select vendors](#_Step_5:_select). How do you make sure you select the best providers of technical services?
6. [Estimate total cost of ownership](#_Step_5:_). How much will your project cost to pilot, scale and maintain?
7. [Create an implementation roadmap](#_Step_7:_). How long will it take to develop, to pilot, to scale up?
8. [Understand and manage project risks](#_Step_8:_Understanding). What can go wrong and how can you plan for that?
 |

Other useful resources for people embarking on ICT projects:

* The “National eHealth Strategy Toolkit[[2]](#endnote-3)” (World Health Organization and International Telecommunication Union, 2012) is an expert guide for the development and implementation of a national eHealth vision, action plan and monitoring framework.
* “Computerizing Logistics Management Information Systems[[3]](#endnote-4)” (USAID|Deliver, October 2012) includes more detail around development and implementation including some of the concepts contained in this toolkit.

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# A history of unsustainable pilot projects

Small-scale *eHealth* and *mHealth* projects and pilots[[4]](#endnote-5) are proliferating in Africa and Asia. Many of these are implemented by not-for-profit or donor organizations in a small geographic area and with a narrow functional or programmatic scope (for example: a stock tracking and reporting system for malaria drugs in a particular district). Despite the interest of ministries of health and some donor organizations to invest in information technology, there are not many success stories of widely implemented systems.

What is holding back the widespread adoption of information systems in the health systems of developing countries? Why do so many seemingly great ideas never pass the pilot phase? Why do some sophisticated and proven systems bring little value or improvements to the health system?

Typical barriers and pitfalls include:

* Managers take shortcuts through established system development methodologies: they don’t spend enough time on analysis and design, and therefore the development time and effort escalates.
* Technical assistance providers and donors sometimes have agendas that are not aligned with the interest of the system users.
* Systems use an architecture that is not suitable for their envisioned scale and scope.
* There is often a premature commitment to a fixed budget and schedule, with insufficient resources dedicated to the project areas that are not well understood by the planners.

Unfortunately, many ministries of health lack the staff and general capacity to plan adequately for information systems projects, and a document like this cannot address all those shortcomings. However, it can help planners think through the challenges of each phase of an ICT project.

Typically, there are three main phases: develop, scale, and sustain.

 

1. First, the team develops or selects the right solution, based on your needs and priorities. The system is tested in a small-scale pilot to measure outcomes, impacts, costs, and ways to optimize.
2. In the scale phase, the system is deployed to its intended reach, for example in all districts in the country, going from 50 to 2,000 users.
3. In order to provide continued value, the system needs to be maintained and sustained. After 5 to 10 years it may need to be improved or even replaced, starting again with the first phase.

Quality assessments should be planned between each phase: the decision to move from design phase to national scale depends on the successful conclusion of a pilot demonstration. After the system has been scaled up, the outcomes are evaluated against the original project objectives, and if necessary design changes are made. In the box below, we describe a number of real-life project failures and speculate how better planning could have led to success.

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| Examples of project failures |
| * **Limited design.** In the context of a technical knowledge transfer program sponsored by the European Union (EU), an E.U. country helped a middle-income country implement its immunization registry system. After the program ended, the receiving country’s officials discovered they had no way to modify reports, functionality, or even access the database directly. They abandoned the system.*What went wrong?* Probably not enough time was spent planning and designing the project. It was assumed from the start that what worked in one country would also work in another. Many factors beyond functionality will impact the feasibility and usefulness of a system in a specific country.
* **Not planned to scale.** A consortium of donors and technical partners implemented an SMS-based system to track the commodities used in one program in an African country. While it was scaled up nationally for a handful of commodities, it will not be easy to extend its use to a large number of other commodities: it will be too cumbersome and costly to send a different text message for every transaction of a large number of items. *What went wrong*? The system was not designed for a broad vision. Instead, it focused on the demonstration of a technology. Failing to think through what would happen in the longer run meant that the system might not be maintained.
* **Risk management and implementation issues.** Rich countries suffer failures too. The United Kingdom’s “National Health Service National Programme for IT” was established in 2002, with the aim to implement an electronic medical record system, among other goals. Initially the program was expected to cost £2.3 billion over three years, but in 2011 it was dismantled after having spent £6.4 billion without achieving its initial goals[[5]](#endnote-6). *What went wrong*? Probably many interlinked factors explain a project failure, but one could be that the project risk was not well managed by being too ambitious about scope and scale from the start. A well-planned pilot phase, with a well-managed scope would have limited the financial risk.
 |

# Define outcomes

As countries continue to strengthen their health systems, an investment in information and communication technologies is often needed. However, national public health systems have several competing priorities, and the decision to invest resources in information technology can be difficult. Being clear about key goals and the scope of the project can help stakeholders rally around common goals.

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| Take this step will help you answer |
| * What do I need my information system to do?
* How does an information system help us implement our strategy?
* How do I get the support of my major stakeholders?
* Where is the system going to be implemented?
* How will I measure success?
 |

## Identify problems and opportunities

You may already have a project in mind, and the benefits of that project may seem obvious to you, but it is still useful to identify the specific problems you are trying to solve and the benefits you hope to gain. Being clear about what you are trying to achieve from the beginning avoids misunderstandings between the various stakeholders. It also helps you evaluate the success of your project. Think about what problems in your health system could be solved if you or other health workers had better (more accurate, complete, timely, or relevant) information. Where possible, obtain quantitative data that can be measured again to show improvements. Successful ICT projects will produce many kinds of benefits for all of its users. Table 1.1 below shows the kinds of benefits information systems can bring.

Table . Benefits of information systems

| **Benefit** | **Examples** | **How to evaluate success** |
| --- | --- | --- |
| **Better indicators for strategic planning** | * Vaccination dropout rates are higher than average in specific population groups, which could be addressed by targeted advocacy efforts.
* Credible estimates of vaccine wastage rates per health center lead to tailored vaccination strategies to reduce wastage.
* High failure rates in certain types of cold chain equipment lead to the discontinuation of this equipment.
 | * Did the system produce credible data for these indicators?
* Were managers able to act on this information?
* Did the information change decisions and how did that benefit the program?
 |
| **Better day-to-day decisions** | * A district officer validates a vaccine request based on the available stock, target population, and average consumption in the health center that sent the request.
* A nurse uses the immunization register of her clinic to find the children that are falling behind their vaccination schedule.
* A warehouse manager analyses average demand and makes sure that stock is kept between minimum and maximum levels.
 | * Did the system lead to more efficient operations, for example less buffer stock or wastage?
* Did it lead to better availability of stock?
* Did it change the way people work and did that improve health outcomes (for example higher coverage, lower drop outs)?
 |
| **Better control and oversight** | * In Senegal, some health programs have outsourced the distribution of their commodities to the national pharmacy. They request access to stock and delivery information to allow them to monitor that arrangement.
* In Turkey, pharmacists scan barcodes when they dispatch drugs to make sure that the insurance system isn’t over-billed.
* Through a last-mile stock management system, managers can monitor whether some health centers or districts are hoarding stock, or are running out all the time.
 | * Does the system data accurately reflect reality?
* Did the system reduce fraud or highlight poor performance?
 |
| **Reduced administrative burden** | * Health workers enter monthly reports directly in a computer and transmit them electronically
* Aggregate coverage reports are generated automatically by the system
 | * How does the amount of time people spend before and after implementation of the system change?
 |
| **Other benefits** | * Old system needs to be replaced because it is not reliable or cannot be integrated with other systems.
 | * Does the new system produce information that is at least as good as the old system, while it is now more reliable or inter-operable?
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👓 Case Study: Albanian Immunization Information Systems

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| In Albania, the Institute for Public Health and Project Optimize worked together to implement an immunization information system (IIS) that digitizes the child immunization records and the stock management system in an integrated manner. By recording every individual child, vaccination, and stock movement in a central database, the IIS is able to provide the following benefits:1. IIS produces better estimates of immunization coverage *(strategic planning).*
2. Managers can list the registered children that are unvaccinated and use that list to find out why *(strategic planning).*
3. Reminders and automated work planning reduces dropout rates and improves the timeliness of vaccination *(better day-to-day decisions).*
4. When a bad lot needs to be recalled, managers can find out easily where it was distributed and to which children it was administered *(better control and oversight).*
5. IIS allows officials to check whether new and more expensive vaccines are administered to the children they were meant for *(better control and oversight).*
6. As a bonus, nurses spend less time preparing for vaccination sessions and reporting to the district *(reduced administrative burden).*
 |

## Negotiate the scope

Setting and respecting boundaries will be a key success factor for your project. This is achieved by clearly establishing and agreeing on the scope - that means defining what is and is not included in the project - in these dimensions:

1. The **functional scope** of the system refers to what it does. Will it support patient records, disease surveillance, stock management and logistics? Advocacy and outreach? Finance and accounting? Human resource management?
2. The **programmatic scope** refers to the public health programs that will be using the system. Is it going to be made specifically for one program or integrated? To answer this question, it is worth thinking about the end users of the system. Will they end up needing several systems to do their job? In that case, their development needs should be coordinated.
3. The **geographical scope** of the system refers to where it will be used, and by whom. Is it meant for nation-wide deployment? At what levels of the health system? In hospitals? District offices? Community health centers?

You cannot deploy a system that does everything for everybody from the start. It makes sense to begin with a *pilot*, in which the scope is reduced to make the implementation more manageable and allow you to find and correct weaknesses before you add functional, programmatic, or geographic scope. Often, that is achieved by testing the system first in one geographical area, and with a core set of the final functionality. After evaluation, it can then be scaled geographically first, after which new layers of functionality are added over time, or it can be perfected and complemented with new functionality before it is rolled out nationally.

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| The following tools can help you define project outcomes more precisely:* **Project charter / TOR**: at the start of a major ICT project, management should summarize what the project will accomplish in a project charter, or in a Terms of Reference document (TOR). That way, there is no confusion about the project’s objectives and targets. (see Annex 1: Sample Project Charter)
* **Monitoring and evaluation framework:** helps to focus attention on the objectives of the project. Select key indicators that will reflect project success, then measure them before, during and after project implementation. (Annex 2: Sample Monitoring and Evaluation Framework)
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# Form your team

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| By taking this step, you should be able to answer…  |
| * What resources and skills do I need for each of the three phases (develop, scale, and sustain)?
* How can I assess what skills are already available in the ministry of health, other ministries, or partners?
 |

By now, it should be clear that there is more to ICT projects than developing software. At a minimum, you need to think how to implement the following project functions:

## Governance

Within the implementation of ICTs and communication technologies, there are numerous groups with different objectives and interests, which can complicate decision-making. Knowing the various perspectives and finding areas of consensus and collaboration are important for project success.

Table .. Different Views of different stakeholders involved in an implementation.

| **Group** | **Observed objectives and interests** |
| --- | --- |
| Ministries of health and finance | Improved outcomes from investment.Implementing on time and within budget, meeting user requirements. |
| Ministry of IT and telecommunication  | An integrated overall e-Government strategy. Levering existing investments in IT servers, communication network etc. |
| Funding sponsor | Showing value for the investment and the project having lasting impact. |
| Users | A system that meets requirements with acceptable usability and performance.Having enough flexibility to meet local needs. |
| Project team | Meeting short-term criteria set by project sponsors and funding organization. |
| Sub-contractors | Receiving near- term payments for services delivered. |
| Vendors | Long term revenue stream. |
| Researchers | Validating hypotheses, contributing to publications, and/or seeking regulatory approval. |

In order to align interests and resolve potential conflicts, a champion from the senior level of the ministry is critical for success of projects of significant magnitude.[[6]](#endnote-7) This person chairs a committee of stakeholders, which sets the overall direction for the system implementation, makes key decisions, and identifies key team members.

## Management

The project needs to be managed (planning and progress control) and supported by administrative functions such as procurements.

## Development

The development or customization of a software system is a specialized and time-limited role. Therefore, the development team normally needs external resources, such as IT contractors or technical assistants. This function is most important in the pilot phase, with minimal support for the scale-up and maintenance.

## Deployment

To implement the system at scale, a new set of skills is required; mostly around training and the mass deployment or upgrade of computer equipment. This function may also rely on short- term technical assistance to some extent.

## Operations

After the system has been implemented, it needs to be maintained, and users will need some form of overall support. That is where the operations team comes in.

Figure 2.1 visualizes these functions.

Figure 2.. Project functions

Governance

Management

Development

Deployment

Operations

Table 2.2 describes the roles that are needed in some more detail. For smaller projects, some of the roles may be combined by in one individual, and some roles may be filled by ministry staff or delegated to implementing partners.

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| * **Roles and Responsibilities matrix:** Consider all the roles that will be required to in your project. Select individuals or even organizations that will fulfill these roles. See Annex 3. Project roles and responsibility matrix
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# Define what your system needs to do

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| By taking this step, you should be able to answer…  |
| * How can I document my system requirements and communicate better with technical people?
* Which processes will be needed to support the objectives and outcomes?
* What are the technical requirements I should be worrying about? How will the information system perform when we have a problem with electricity and or Internet connectivity?
* How does the design of my health information system enable our country to maintain it? Is it possible to design an information system so that training is minimized?
 |

In a typical project, managers and staff of a unit or department work together with technical people: vendors, developers, consultants, or IT staff in the ministry of health. Often, these two groups have completely different backgrounds and even seem to speak different languages. As a result, lack of clear understanding between the future users of a system and the people who design it is one of the main causes of frustration, delays, cost overruns, and even failures in ICT projects. At a minimum, the unclear understanding creates a system that does not quite correspond to with user expectations. People who can navigate easily and communicate effectively with public health and information technology professionals are unfortunately in short supply. Luckily, having a good methodology can help. A method that has been adapted for low resource settings is the Collaborative Requirements Development Methodology (CRDM). CRDM recommends following a few steps to create three documents that:

1. Describe the processes to be computerized
2. Create task flow diagrams
3. Define user requirements

## Describe processes

A process is a set of tasks that together accomplishes a goal or produces something of value for the benefit of the organization[[7]](#endnote-8). Complete a process matrix to help document areas of improvement (see Table 3.1). Normally, the matrix is completed in the following order:

1. Process: A short title given to a process.
2. Objective: A concrete statement describing what the process seeks to achieve.
3. Outcomes: Indicates how the objective will be met. This can often be measured (e.g., how much, how often, decrease in incidents, etc.).
4. Input: Information received by the business process from external sources.
5. Output: Information transferred out from a process.
6. Task Set: Five to seven key steps that are part of the process.

The process matrix in Table 3.1 includes illustrative processes for an Immunization Information System (IIS). This or other templates can be considered to help you with your work, and should be adapted for your situation. Thinking through the process will help you identify the details that are critical for your context.

Table 3.. Example process matrix

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Outcomes | * More complete registration of newborns
 | * More timely vaccination, higher vaccination coverage
 | * Higher availability of vaccine and other stock
* Lower wastage
 | * Higher uptime of cold chain equipment
 | * Reference data available for other systems / processes / modules
 |
| Task Set | 1. Register patient
2. Search for existing record
3. Maintain patient database
 | 1. Define national schedule
2. Plan vaccination
3. Send reminders
4. Register vaccinations
5. Monitor vaccination coverage
 | 1. Order stock
2. Receive
3. Store
4. Count stock
5. Monitor balances, expiry dates, wastage and usage
 | 1. Register equipment
2. Update working status
3. Monitor working status
 | 1. Define health facilities
2. Define system users
3. Define stock items
4. Define geographies
 |
| Output | * Patient records available for other processes in the application
 | * Vaccination records
 | * Data about available lots for process B “Vaccination management
 |  | * Reference data
 |
| Input | * Patient Information from Hospital information systems
* Newborn information from civil registry systems
 | * Patient records from process A “patient management”
* National immunization schedule
 | * Historic vaccine usage data from process B “Vaccination management”
* Stock available?
 |  |  |
| Objective | Maintain a database of all newborns, with their vaccination history | Ensure that all infants are vaccinated with all vaccine doses in the national schedule  | Ensure that vaccine and other stock is always available when needed, while minimizing wastage and excess stock | Ensure that high quality cold chain equipment is available where needed | Provide common reference data for other modules and processes |
| Process | Patient management | Vaccination management | Stock Management | Cold chain management | Reference data management |
| # | A | B | C | D | E |

## Create task flows

A task flow diagram can be used to illustrate activities of a business process as well as those who would perform the activities. The task flow provides a “story” for the process and serves as a focal point for achieving clarity and agreement among core group members and stakeholders. Tasks are steps within the process that can be performed from start to finish by a single entity without interruption. The diagrams look like standard flow charts. Figure 3.1 shows technical officers describing and simultaneously improving a set of task flows.

Figure 3. Collaborative requirements session



They have a start and end, and are read from left to right or top to bottom. Rectangles are used to describe the steps. Diamonds indicate decisions, and arrows indicate the sequence. They also specify who is responsible for the step and where it is taking place. A sample task flow diagram is shown in Figure 3.23.

Figure 3.. Sample task flow for drug dispensing



## Define requirements

Requirements specify what is needed to solve a problem or to achieve the objective. Requirements may also be rules required within the system to satisfy a contract, standard, or specification. For the purpose of this document, we distinguish functional and non-functional requirements.

**Functional requirements** are usually expressed as statements that begin with “the system must or should…” They express the functional abilities of a system; for example the ability to generate a certain report, or the ability to keep track of individual lots of a vaccine. An example of a requirements matrix is shown on the following page. This list can be used: (a) to evaluate an existing system (does it comply with the requirement?); (b) to communicate these requirements to a developer who can find the best way to implement them; or (c) as a checklist to test a system that was developed.

Table 3.. Example user requirements template

|  |  |  |  |
| --- | --- | --- | --- |
| **Process** | Vaccination management | **Contact** |  |

|  |  |  |
| --- | --- | --- |
| Step | Must? | The system must or should… |
| 1 | ✓ | Allow the user to define a national vaccination schedule. This schedule defines the ideal age at which children should receive a certain vaccine dose within three constraints: 1. The minimum age before which a child is not eligible for a certain dose.
2. The maximum age beyond which a child is not eligible for a certain dose.
3. A minimum time that needs to pass between doses of a same vaccine.
 |
| 2 | ✓ | Reproduce (display and print) a list of children requiring immunizations from a certain health center at a particular time, with all the doses that are due and overdue.  |
| 3 |  | Send SMS (text messages) reminders to caretakers.  |
| 4 | ✓ | Allow users to update a child’s immunization record with the date of vaccination, the health center where the vaccination took place, and the vaccines and doses that were administered.  |
| 4 |  | Register the lot number that was used for each vaccination in a child’s immunization record.  |
| 4 | ✓ | Reproduce (display and print) a child’s vaccination history, together with all due and overdue appointments.  |
| 5 | ✓ | Reproduce (display and print) a coverage report that shows vaccination coverage as the percentage of the children living in a certain area that were born in a certain timeframe and that were vaccinated with a certain vaccine dose. (Cohort reporting) |
| 5 | ✓ | Reproduce (display and print) a report that shows all vaccinations administered by dose, by health facility or group of health facilities (district, region, country).  |

**Non-functional requirements** often describe the technical and environmental constraints that vendors and developers need to understand such as the availability of electricity and Internet connectivity in certain areas; mobile devices that can be purchased locally, etc. A checklist is included in “Annex 5. Non Functional Requirements”.

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| * **CRDM tools:** For more information on how to define processes, task flows and functional requirements please see Annex 4. What is CRDM?
* **Non-functional requirements:** for a checklist of, please refer to “Annex 5. Non Functional Requirements
 |

# Find the right solution for your problem

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| By taking this step, you should be able to answer…  |
| * What are others doing?
* What is an enterprise architecture and why does it matter?
* Should we build, buy, or adopt a system?
* What is open-source software, and Software as a Service (SaaS)?
* Is open source software always a better alternative than purchasing from a vendor?
* How do I compare various options objectively?
 |

Now that you know what you want to achieve, and what your system needs to do, you will need to find the best solution for your problem and context. In this step, you are asked to think about an appropriate system solution that is aligned with your context and national information architecture.

## What are others doing?

Too often, the wheel is reinvented when it comes to developing software. Even if you are convinced that you will need a system that is custom- developed for your needs, it still makes sense to have a look at what other people are doing, in a different country or even in a different program in your country. This is not always easy; there is no single repository that has all this information. Furthermore, information that is available is most often advocacy-oriented, low on actual lessons learned or technical details. Below are a few resources that may be useful.

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| RESOURCES |
| * **Technet-21.org**: Technical network for strengthening immunization services. This is a community-based forum and sharing network, moderated by the World Health Organization, and mostly used by logisticians at global, regional, and country levels. It contains an increasing number of posts about information systems in immunization programs.
* **OpenLMIS.org**: A collaboration of domain experts in logistics and supply chains, eHealth information systems, software development for low-resource settings, and process improvement. Like other open initiatives, the intention is to ensure OpenLMIS becomes a place for sharing information about LMIS planning, requirements and system design, promoting interoperability between systems, developing open source solutions for effective, scalable, and sustainable solutions.
* **HINGX.org**: (Health Ingenuity Exchange): A community-driven platform that brings together reusable tools, guidelines, and personal experience in Health Information Systems. Resources are likely most useful for eHealth or ICT professionals.
* **WHO and UNICEF**: Engaged in the development and promotion of health information systems. Provide regional meetings that are an excellent opportunity to exchange with people from other countries or hear about best practices.
 |

## Enterprise architecture

“Enterprise architecture” is a concept that is common in business settings, but less so in the global health context. It represents a systematic approach towards information system implementations to increase the likelihood of effective management and sustainability, for example by demanding adherence to standards and policies. Figure 4.1 illustrates a conceptual model for how it is constructed. In the absence of this common approach, donors and recipients often skip aligning to a national strategy, and choose a health application to meet their immediate and segmented needs. This creates a situation that is very difficult for the ministry of health to manage and sustain. This document doesn’t address the complex issue of alignment around a national architecture, but other resources exist, such as the e-health toolkit mentioned before.

 

Figure .1. Enterprise Architecture model

## Different software models

Before diving in to a specific software solution, it is useful to consider the advantages and disadvantages of the different strategies that exist to acquire a software system: you can build a system from scratch or take choose something that already exists. That can be a commercial application, or a freely available system. Table 4.1 below provides an overview of the available options.

Table 4.. Different software models

| **Model** | **Pros** | **Cons** |
| --- | --- | --- |
| **Custom developed software** Software system is built from scratch. Examples: Project Optimize demonstration projects in Albania, Vietnam, Senegal, and Guatemala. | Full control over selected technology, functionality and design. Development experience creates ownership and improves sustainability.Possibility to engage the local IT industry. | Custom development tends to be difficult to manage within time and budget. Control over design does not guarantee satisfaction with the end product. |
| **Commercial Off-the Shelf (COTS)** The same kind of system as commonly in use in commercial enterprises. Examples: SAGE ERP, which is in use in many countries in Francophone Africa for essential medicines. | Shorter lead time from selection to implementation.The system can be evaluated before being acquired.Depending on level of maturity, product may have some level of prior experience and refinement | Often expensive and sold with unclear complex fee structures.COTS is not often designed for implementation in low-resource settings. |
| **Free packaged software** Software developed by a donor organization or technical agency. Alternatively, the system that was developed by a neighbor country. Examples: PIPELINE (USAID/JSI)SCM (USAID/JSI)VSSM (WHO), SMT/DVD-MT (WHO) | Same advantages as with COTS.No upfront cost. | Dependence on “vendor” for maintenance. or customizationThere is no contract, so service and warranty for bug fixing not available.Many of the implementation and running costs are hidden. |
| **Open source software (OSS)** The source code as well as the software product is freely available. Often a community has been formed to support the OSS. Examples: OpenLMIS.orgopenMRS.orgDHIS2.org | Right to make changes to the software.Possibility to engage the local IT industry.Benefit from communities and share development costs with other organizations. | User interface may be confusing.Can end up with a poorly supported product.A loosely knit community might not be able to provide the business relationship you need.Some of the implementation and running costs are hidden. |
| **Software as a Service (SaaS)** Database and application are hosted on remote servers, so software is not sold as a product but as a service, that can be contracted per user and per month or year. For example: LogistimoEPI SurveyorSMSForLife | Highly feasible to implement and maintain.Clarity about the cost to implement and run a SaaS application.Investment in improved software can easily be shared among customers. | Data hosted on remote servers: not always in agreement with national policy.Ministries of health are not often well positioned to pay a regular service fee. |

🛠 Toolbox

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| * **Selection Matrix: i**deally, a few good systems can be identified. “Annex 6: Selection matrix” can help you select the best alternative option.
 |

# Select the right vendors

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| By taking this step, you should be able to answer…  |
| * How can I select the right vendors and consultants?
* How do I ensure that a contract for an information system clearly specifies how the system should perform?
* How will I ensure that short-term technical consultants will provide my team with the knowledge and skills I need to sustain my information system?
 |

## Issue a request for proposal (RFP)

To select a vendor your team may wish to start by writing a request for proposal (RFP), outlining what will be expected from the technical partner. The functional and non-functional requirements that were outlined in Step 2 are a first good element to include in an RFP, as they clearly communicate what you expect from a system. The RFP should also explain how proposals will be evaluated and what elements they should contain. Proposals should include at a minimum:

* A description of the proposed solution and how it will be implemented in your context.
* An implementation work plan with timeline, methodology, roles, and responsibilities.
* The technical and organizational capabilities of the vendor, highlighting past projects that are most relevant for this work.
* The cost and level of effort, including the effort required from MOH staff.

## Evaluate the merit of each proposal

When vendors’ proposals are received, they are normally screened by a core team, and then evaluated by a procurement committee. Having broad expertise on a procurement committee can help ensure key aspects are not missed. This expertise should include subject matter experts in the system domain (e.g., immunization systems, logistics, laboratory systems, etc.), system architecture, business analysis, project management, software development, procurement, and senior management. The committee will be responsible for evaluating the proposals and award scores based on the evaluation criteria set in the RFP.

Often two or three high ranked viable proposals are selected, and a winner is then selected only after demonstrations and vendor presentations to the procurement team. The goal of in-person interviews is to clarify any doubts and to assess whether good rapport exists between the individuals that will be working on the project.

## Evaluate the cost of each proposal and select a vendor

Next, evaluate the cost of the shortlisted proposals. This is a difficult matter because you should consider not just the contracting costs for this vendor, but also any implication on the overall life cycle costs of the system. Sometimes it may be justified to select a proposal or system with a higher upfront cost if the maintenance costs are expected to be lower.

## Make a contract or Memorandum of Understanding (MOU)

Finally, award a contract to the winning vendor. If you won’t have a commercial relationship with the selected technical partner (for example because it is an NGO or University that receives funding from a different source), you may still choose to formalize your collaboration in a memorandum of understanding.

The contract or MOU may refer to the RFP or contain its main elements. It clearly describes the expected deliverables and may stipulate milestones: what key outcomes are expected by when? Failing to hit these milestones may lead to deferred or reduced payment.

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| * **A proposal selection matrix** will help you evaluate multiple received proposals in a systematic and standardized way. A sample matrix is included in Annex 7: sample proposal scoring matrix
* **Vendor questions:** it is not always easy to ask the right questions from technical vendors. For a list of suggested questions please see “Annex 8. Vendor Questions”
 |

# Estimate implementation and operating costs

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| By taking this step, you should be able to answer…  |
| * + How much will this information system cost to develop, scale, and sustain over five to ten years?
	+ What are the individual major cost categories and the variables that drive these costs?
	+ How do I budget for information system support and maintenance?
 |

With the prevalence of pilot projects, there are not many examples of the costs associated to scaling or sustaining information technology in the public health sector. Too often, only the costs related to initial development and piloting are sufficiently understood. Understanding the total cost of ownership (TCO) is important for countries to understand the funding needs and the long-term impact on the program budget. In addition, looking at the total cost of ownership helps to drive greater investments in certain aspects of the system. For example, an initial investment in improved usability may reduce long-term training and support costs. In addition, adherence to standards can help the data outlast the system and ease eventual migration costs.

The TCO includes not just the initial investment, but also the costs to scale and sustain the system over three to five years after the system is deployed. Sometimes costs seem to be hidden, and only through incorporating all of the costs will decision-makers have critical knowledge to know if they are receiving value for the expected impact.

The figure below shows a hypothetical but representative cost profile that clearly shows how the largest costs will not be incurred in the development, but in the consecutive scale and sustain phases of the system’s life cycle.



## What drives costs in an ICT project?

WHO/ITU estimates that eHealth projects typically allocate 60 to 70 percent of the budget to human resources (with an emphasis on training). Approximately 10 to 15 percent is spent on additional equipment, another 10 to 15 percent to support ongoing operations with the remaining amount for other aspects of the project.[[8]](#endnote-9) Based upon the scale of the system and the existing ICT infrastructure, the percentages may vary.

During different phases of the project from development to deployment and operational support, the spending on various cost categories changes:

1. Research and development, costs are mostly determined by the functional, technical, and organization complexity of the project. Costs do not vary significantly for a large or a small country.
2. Scale- up costs are driven by the number of future users, by the way in which they will access the system (e.g., desktop computer, mobile phone, paper), and by the cost per user to deploy it (e.g., training, providing the hardware)
3. Operational costs to support and maintain the system are driven by the number of users and the selected technology. This is the most critical component of the TCO. The cost to maintain the system should provide an ongoing benefit that outweighs this cost. When seeking to manage the cost of operations, the organization should review ways to reduce the costs of:
* Data and communication plans.
* Software and hardware maintenance fees.
* Hardware replacement.
* Ongoing training needed due to staff turnover. and refresher training

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| * **Detailed costs drivers and further discussion** in “Annex 9 what drives costs in all phases of the project life-cycle?”Annex 7: sample proposal scoring matrix
* **A sample budget matrix** can be used to summarize the main spending buckets and allocation across categories. See ”Annex 10 TCO Budget matrix”
 |

# Create an implementation roadmap

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| By taking this step, you should be able to answer…  |
| * + What are the key tasks necessary for successful deployment?
	+ When will the system be ready?
	+ How do I manage time, risks, and budget?
	+ How do I break the project into discrete milestones so that we demonstrate value and progress to all stakeholders?
	+ How do I monitor whether the project is meeting its objectives?
* What role should I play during the implementation?
 |

When expanding to interconnected information systems, the implementation complexity increases. Unlike a Microsoft Excel spreadsheet or an Access database that is managed by a few individuals, the process and role changes involved for greater impact at scale require substantial effort to develop, deploy, and maintain.

Many research studies have documented that a significant percentage of technology projects are late, significantly over budget, or are cancelled. Often, the problems can be traced to lack of resources and changing scope and requirements that are not properly managed. Having a plan and following a project methodology is key to ensuring success. Ideally, an initial implementation plan is created prior to or as part of the process of selecting vendors. The contracting process should establish key milestones for the delivery and acceptance of the application, and simultaneously uncovers assumptions and clarify accountability of the organization in order to keep the project on time and on budget. At the end of contracting, you should have a good understanding of when the system should be ready.

The key tasks to be incorporated in the implementation plan vary by the phase of the project. The International Telecommunications Union provides a starting methodology that is incorporated below along with recommendations from the Consultative Group to Assist the Poor (CGAP). Several of the key steps have been covered in previous sections of this document. However, they are replicated below to provide an inclusive list.

Once the executive sponsor and senior leadership have established the vision and defined the outcomes, much of the responsibility for tactical details should be handled by the management staff and other team members. However, the sponsor and senior leadership need to remain involved in the following ways:

* Participate in regularly scheduled meetings to review project status.
* Coordinate partners and facilitate collaboration with all levels of the health system.
* Provide oversight for issues that cannot be resolved by members of the project team, maintaining the focus on the project goals and scope.
* Hold team members accountable for their roles and responsibilities, ensuring that the various departments and components of the health system support project activities in good faith and adhere to work plans and schedules as determined in their individual work plans.
* Assess performance of the team and ensure that the organization takes ownership of operations.

The project phases have been divided into discrete milestones to show and report progress. The management team for the project should be monitoring the timeline, budget, and quality, as well as managing risks. Ideally, the milestones correlate to the reporting rhythm of the organization, e.g. quarterly, or annually.

# Understanding and managing project risks

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| By taking this step, you should be able to answer…  |
| * + What are some critical factors for project failure?
	+ How can risk be managed?
 |

Following the seven steps described above should lower project risk by aligning requirements to organizational objectives, securing appropriate funding, and choosing the right vendors and partners. In spite of the planning that takes place, a significant number of projects have a different outcome than expected. In addition, low adoption by the intended users may prevent the system from achieving the intended results. Perhaps most concerning are projects that continue to invest resources and political capital regardless of information showing limited chance of success. What are the common risks for failure in a project and how can they be managed?

## Common risk factors

Governance.
Projects that do not have active participation or adequate representation by the senior leadership often struggle. In fact, many state that committed executive sponsorship is the most important factor for project success. Furthermore, lack of sponsorship can result in resistance by the users of the system, feeling that the system is being forced upon them. Symptoms of governance problems include requirements that do not align with your organizational objectives as well as resources being re-assigned to higher priority projects at various levels of the health system.

Management.
Management is a collaborative effort requiring individual, team, and organizational skills. The management team will be responsible for effective planning as well as ensuring the project transitions from development, through deployment and into operations. The management oversees both technical and non-technical activities. The vendor partners and other stakeholders can help mitigate risk. At the same time, if they are not managed, they may also contribute to the risk when there are conflicting priorities.

Development
During development, three common risks are changing user requirements, developing a product that does not meet the initial requirements, and misunderstanding the technology environment. To mitigate the risk, the team should: (a) establish a development methodology; (b) have a clear understanding of the scope and measures of success; (c) validate the requirements through continued interaction with the users; and (d) manage scope and requirements, escalating to the governance committee, if necessary.

Deployment
A key component of deployment is managing the organization through change. Typical risk factors include: (a) imposing a change without input from those who are affected; (b) failing to realign a process to support a new solution; and (c) not providing adequate support to new users. Teaching new procedures takes time. As the system is scaled, there may be delays procuring the necessary number of devices and adapting to regional differences.

Operations.
The organization will need to be prepared for the changing needs in staffing levels. Having inadequate funds to pay staff and suppliers can lead to an insufficiently staffed project team further resulting in an unusable system. There is increasing demand for information and communication technology skills in the commercial sector, and it may take time to hire and train additional staff to support the system.

Table 8.. Risk Checklist[[9]](#endnote-10)

*Assess the following risk items. Check yes, if the risk is present in the project. Check no, if it is not. Add additional risk items that are not listed here.*

|  |  |  |
| --- | --- | --- |
|  | Risk | Mitigation strategy |
| Governance |  |  |
| 🞏 Yes 🞏 No | Lack of a project champion |  |
| 🞏 Yes 🞏 No | Misalignment of partners’ objectives and stakes |  |
| 🞏 Yes 🞏 No | Political games/conflicts |  |
| 🞏 Yes 🞏 No | Unreliable external partners |  |
| 🞏 Yes 🞏 No | Lack of support from upper management |  |
| 🞏 Yes 🞏 No | Organizational instability |  |
| 🞏 Yes 🞏 No  |  |  |
| Management |  |  |
| 🞏 Yes 🞏 No | Changes to membership on the project team |  |
| 🞏 Yes 🞏 No | Lack of project leadership |  |
| 🞏 Yes 🞏 No | Lack of required management knowledge or skills |  |
| 🞏 Yes 🞏 No | Lack of clear role definitions |  |
| 🞏 Yes 🞏 No | Large and complex project |  |
| 🞏 Yes 🞏 No | Scope creep |  |
| 🞏 Yes 🞏 No | Changes to requirements |  |
| 🞏 Yes 🞏 No | Insufficient resources |  |
| 🞏 Yes 🞏 No |  |  |
| Development |  |  |
| 🞏 Yes 🞏 No | Introduction of a new technology |  |
| 🞏 Yes 🞏 No | Unreliable technical infrastructure or network |  |
| 🞏 Yes 🞏 No | Complex software solution |  |
| 🞏 Yes 🞏 No | Complex/incompatible hardware |  |
| 🞏 Yes 🞏 No | Poor software performance |  |
| 🞏 Yes 🞏 No | Poor perceived system ease of use |  |
| 🞏 Yes 🞏 No | Poor perceived system usefulness  |  |
| 🞏 Yes 🞏 No | Misalignment of CIS with local practices and processes |  |
| 🞏 Yes 🞏 No |  |  |
| Deployment |  |  |
| 🞏 Yes 🞏 No | Unrealistic user expectations |  |
| 🞏 Yes 🞏 No | Overall resistance to change |  |
| 🞏 Yes 🞏 No | Lack of cooperation/commitment from users |  |
| 🞏 Yes 🞏 No | Lack of computer skills and knowledge among users |  |
| 🞏 Yes 🞏 No | Prior negative experiences with ICT projects |  |
| 🞏 Yes 🞏 No |  |  |
| Operations |  |  |
| 🞏 Yes 🞏 No | Lack of local personnel knowledgeable in ICT |  |
| 🞏 Yes 🞏 No | Lack of predictable long term funding |  |
| 🞏 Yes 🞏 No |  |  |

# Annex 1: Sample Project Charter

|  |  |
| --- | --- |
| **Vision / objectives**: A concise description of what outcomes are expected from the system. Describe how the organization will benefit at the end of the project |  |
| **Background**: Current situation that requires a system change; inventory of existing tools and systems; context diagram that visually represents the project participants, problems, and opportunities.  |  |
| **Functional scope:** A brief description of the main functional blocks or modules that will be included.  |  |
| **Programs to be included**: Which of the Ministry of Health departments and programs will eventually use this system? Will it at first only include a subset and then be expanded?  |  |
| **Geographical scope:** Where will the system be implemented over time? Where will it be piloted? Who will be using it? District people or also at health center level?  |  |
| **Participants**: List of individuals whose input has been gathered as part of the scope definition |  |
| **Timing**: By when do you expect the system to be operational at pilot level? And at scale?  |  |

# Annex 2: Sample Monitoring and Evaluation Framework

To be included, based on Optimize M&E Framework

# Annex 3. Project roles and responsibility matrix

| Role | Responsible Individual |
| --- | --- |
| Governance Team |
| Senior ministry sponsor: Holds overall accountability for the project. Represents the organization that is the major recipient of the system benefits.  |  |
| ***Representatives of relevant ministry of health departments***: May include Planning, Finance, and the programs that are involved in the implementation. |  |
| ***Representatives of donors and technical agencies***: Provide guidance, technical and financial support.  |  |
| Management Team |
| Project manager*:* Takes on the responsibility for day-to-day direction of the project, communicates with the governance team, and ensures the system is deployed on time and on budget. This role is ideally filled in by an influential and skilled person within the ministry of health, but can be supported by technical partners. This is the first step towards a successful project. The project manager should excellent managerial, technical and negotiation skills. |  |
| Procurement: Ensures that implementation partners are following organizational guidelines for contracting and licensing. |  |
| Research, monitoring, and evaluation: Individual or team responsible for providing management with of the measurement framework and documenting indicators. |  |
| Enterprise architect*:* Assists with the information technology system’s architecture and supports organization’s health strategy.  |  |
| Development team  |
| Business analyst: Models current operations and documents requirements described by the users of the system users for the identified health system domain. Identifies areas where improvements in workflow are warranted. Serves as a facilitator who is skilled in methods to reach rough consensus on key decisions and move forward in an efficient manner. This is a key role. |  |
| System analysts, software engineering and test specialists: Transforms business and information requirements into specifications for information systems. Implements specifications using the technologies chosen to support the organization. Validates system meets functional and non-functional requirements at the proper scale.  |  |
| Content, standards, and localization: Creates and localizes technical documentation, operations manuals, and user manuals.  |  |
| Deployment team |
| Hardware, telecommunications, and networking services: Provides services to procure, deploy, and configure components that are necessary in the field as well as provide consumable supplies such as paper and ink cartridges for printers.  |  |
| Training: Trains end users and administrators of the system.  |  |
| Operations team |
| Data center/ hosting*:* Installs, configures, maintains, and monitors the system within the data center. Applies ongoing security patches and manages data back-up and restoration activities.  |  |
| System administration: Oversees overall configuration of the HMIS. Monitors system use and serves as secondary level of support escalation from call center operations.  |  |
| Help desk /support: Provides different methods of support via email, voice, and even in person.  |  |

# Annex 4. What is CRDM?[[10]](#endnote-11)

Short practical CRDM guide to be developed.

# Annex 5. Non Functional Requirements

The following tables can be used as a basis for creating country-specific non-functional requirements as well as evaluating other systems.

|  |  |  |  |
| --- | --- | --- | --- |
| System Name |  | Evaluated on  |  |
| Organization |  | Submitted By |  |

**Category: Performance**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 1.1 | Make efficient use of data communication time | □ | □ | □ | □ |
| 1.2 | Make efficient use of capabilities of lower cost mobile devices | □ | □ | □ | □ |
| 1.3 | Be architected to support data capacity considerations (include those for data transmission, storage and processing) for all users over the expected lifetime of the system | □ | □ | □ | □ |
| 1.4 | Use a database that can scale to support projected transaction volume | □ | □ | □ | □ |
| 1.5 | Provide real time response to transactions submitted by connected devices up to the configured national volume level | □ | □ | □ | □ |

**Category: Compatibility**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 2.1 | Use open standards to promote interoperability | □ | □ | □ | □ |
| 2.2 | Exchange actionable data between systems. Need to enforce semantic interoperability | □ | □ | □ | □ |
| 2.3 | Provide access from internet-enabled devices | □ | □ | □ | □ |
| 2.4 | Support flexible models for data collection (e.g. including paper forms, web forms, SMS, IV, bar code, etc.) | □ | □ | □ | □ |
| 2.5 | Comply with industry standards for data exchange | □ | □ | □ | □ |
| 2.6 | Interface to open source or third-party reporting tools | □ | □ | □ | □ |
| 2.7 | Comply with industry standards for track and trace of supplies | □ | □ | □ | □ |

**Category: Usability**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 3.1 | Allow for flexible configurations based upon the context of use, including the physical and social environment | □ | □ | □ | □ |
| 3.2 | Transmit information in a language (script or voice) that is understood by the user population | □ | □ | □ | □ |
| 3.3 | Emphasize ease-of-use and learnability to reduce training costs | □ | □ | □ | □ |
| 3.4 | Be able to be learned by end users and supervisors to meet specified goals of system effectiveness and efficiency | □ | □ | □ | □ |
| 3.5 | Enable easy data collection, organization and dissemination | □ | □ | □ | □ |
| 3.6 | Focus on the mobile user experience with secondary use of a computer | □ | □ | □ | □ |
| 3.7 | Allow users to find features in two clicks or less | □ | □ | □ | □ |
| 3.8 | Enable pleasing and satisfying interaction for the user | □ | □ | □ | □ |
| 3.9 | Provide a search interface to reduce data entry burden and improve accuracy on mobile device | □ | □ | □ | □ |
| 3.10 | Support real-time data entry validation and feedback to prevent data entry errors from being recorded | □ | □ | □ | □ |
| 3.11 | Support ability to calculate values on behalf of user (eliminating need to add, subtract, multiply or divide) | □ | □ | □ | □ |

**Category: Reliability**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 4.1 | Enable a task to be able to be canceled and rolled back to previous state | □ | □ | □ | □ |
| 4.2 | Enable users to work offline and then synchronize data when data connection is available | □ | □ | □ | □ |
| 4.3 | Allow a task to be interrupted and resumed | □ | □ | □ | □ |
| 4.4 | Enable earlier versions of a record to be recoverable | □ | □ | □ | □ |
| 4.5 | Back up data so that it is recoverable in the event of a system or hardware failure | □ | □ | □ | □ |
| 4.6 | Accommodate loss of connectivity to hosted application (network may become unavailable while a user is in the process of submitting a form) | □ | □ | □ | □ |
| 4.7 | Reliably perform tasks within appropriate time with resistance to failures or deadlocks | □ | □ | □ | □ |
| 4.8 | Be deployed in an environment subject to power loss | □ | □ | □ | □ |
| 4.9 | Allow for client devices with low bandwidth or irregular connectivity | □ | □ | □ | □ |

**Category: Security**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 5.1 | Prevent unauthorized access of a patient's protected health information | □ | □ | □ | □ |
| 5.2 | Provide atomic updating of a record. Atomicity prevents updates to the database occurring only partially, which can cause greater problems than rejecting an entire submission of a form | □ | □ | □ | □ |
| 5.3 | Trace and record changes to data taken by the system and by users (update/delete/add) | □ | □ | □ | □ |
| 5.4 | Allow the administrator to establish access privileges and priorities | □ | □ | □ | □ |
| 5.5 | Support definitions of unlimited roles and assigned levels of access, viewing, entry, editing and auditing | □ | □ | □ | □ |
| 5.6 | Require each user to authenticate by role before gaining access to system | □ | □ | □ | □ |
| 5.7 | Provide flexible password control to align to national policy and standard operating procedure | □ | □ | □ | □ |
| 5.8 | Protect system servers through the use of an Internet firewall | □ | □ | □ | □ |
| 5.9 | Protect against viruses and malware | □ | □ | □ | □ |
| 5.10 | Allow for maintenance of security updates | □ | □ | □ | □ |
| 5.11 | Have a source code audit against security threats | □ | □ | □ | □ |
| 5.12 | Log transactions at time of data entry | □ | □ | □ | □ |
| 5.13 | Maintain transaction log history | □ | □ | □ | □ |

**Category: Maintainability**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 6.1 | Be built using technologies that enables local control, open competition, and transparency of the code | □ | □ | □ | □ |
| 6.2 | Have adequate support resources to ensure scalability and sustainability | □ | □ | □ | □ |
| 6.3 | Promote easier acquisition by supporting a range of devices and form factors | □ | □ | □ | □ |
| 6.4 | Able to access the system at all levels/stores | □ | □ | □ | □ |
| 6.5 | Enable local control of operations | □ | □ | □ | □ |
| 6.6 | Be well documented, including known issues | □ | □ | □ | □ |
| 6.7 | Support repair or upgrade to component in a running system | □ | □ | □ | □ |
| 6.8 | Provide a unique version number for all future updates and releases | □ | □ | □ | □ |
| 6.9 | Enable the system to detect incompatible versions of software running on different components | □ | □ | □ | □ |
| 6.10 | Enable configuration to any national and subnational administrative structure or number of levels | □ | □ | □ | □ |
| 6.11 | Have a support process that tracks and documents bugs from discovery to resolution | □ | □ | □ | □ |
| 6.12 | Enable access to the central system from all levels of the health system | □ | □ | □ | □ |
| 6.13 | Support changes to organizational alignment of facilities and personnel | □ | □ | □ | □ |
| 6.14 | Include a administrable content management system (CMS) | □ | □ | □ | □ |

**Category: Portability**

| ReqID | Requirement | Fully Meets | Partially Meets | Planned | Not Applicable |
| --- | --- | --- | --- | --- | --- |
| 7.1 | Be able to provide continuity and access to data throughout changes in infrastructure (e.g., telecommunications, power) at health post level | □ | □ | □ | □ |
| 7.2 | Support extensibility, or and the ability to accept new services or functionality | □ | □ | □ | □ |

# Annex 6: Selection matrix

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Option 5** |  |  |  |  |  |  |  |  |
| **Option 4** |  |  |  |  |  |  |  |  |
| **Option 3** |  |  |  |  |  |  |  |  |
| **Option 2** |  |  |  |  |  |  |  |  |
| **Option 1** |  |  |  |  |  |  |  |  |
| **Points Available** |  |  |  |  |  |  |  |  |
| **Description** | **Requirements** How well does the option meet the user needs? | **Scalability**Has the system been tested or implemented at the scale necessary? | **Sustainability**Can the system be easily maintained and adapted as organizational needs change?  | **User Fit**Does the system fid well within the existing culture, language, and user processes?  | **Costs**Is the cost of implementation and operations within funding constraints? | **Timeline**Can the system be implemented within the expected timeframe? | **Licensing and Contracting**How well does the system fit the procurement guidelines for intellectual property and use of local resources? | **Score** |

# Annex 6. Governance and design principles

| **Principle** | **Description** |
| --- | --- |
| **Business continuity** | Organization operations are maintained in spite of system interruptions.  |
| **Common use applications** | Development of applications used across the organization is preferred over the development of similar or duplicative applications that are only provided to a particular department or unit of the organization. |
| **Common vocabulary and data definitions** | Data is defined consistently throughout the organization, and the definitions are understandable and available to all users. |
| **Control technical diversity** | Technological diversity is controlled to minimize the non-trivial cost of maintaining expertise in and connectivity between multiple processing environments. |
| **Data is accessible** | Data is accessible for users to perform their functions. |
| **Data is an asset** | Data is an asset that has value to the organization and is managed accordingly. |
| **Data is shared** | Users have access to the data necessary to perform their duties; therefore, data is shared across all functions, departments and units of the organization. |
| **Data quality** | A HIS must comprise clear rules and methods for handling missing or erroneous data and indicators. Correction algorithms should be developed. |
| **Data security** | Data is protected from unauthorized use and disclosure. |
| **Ease of use** | Applications are easy to use. The underlying technology is transparent to users, so they can concentrate on tasks at hand. |
| **Flexible and adaptable** | A HIS must be flexible in order to adapt itself to changes of all kind such as evolving sociologic and economic conditions, changes of the epidemiological situation and the state of health of the population, scientific progress in public health and medicine, and changes in information technology. |
| **Focus on logic of the system before solutions** | Analyze and make apparent the logical structure of the HIS first, and then think about computerization. All software within the HIS including that for hospital information systems needs to be developed and applied in a coherent and coordinated fashion. |
| **Integrated system** | Attempt by all means to create an integrated HIS that serves all users. |
| **Make the system visible and easy to understand** | A health information system needs to have a logical and transparent structure. |
| **Primacy of principles** | These principles of health information systems apply to all parts of the organization. |
| **Reduce burden on data collectors** | A health institution sends a report on paper only to the higher-level institution that needs it most or most urgently. It is then up to the latter to distribute it horizontally to those who require it. A higher-level office never requires ‘summary’ reports from the lower level. |
| **Requirements-based change** | Only in response to business needs are changes to applications and technology made. |
| **Responsive change management** | Changes to the organization’s information environment are implemented in a timely manner. |
| **Simplify registers** | In a given health institution, for each target population that is for each type of unit there shall be only one register. |
| **Simplify user experience** | Coordinate registers and reporting forms between them by their layout and by a clear designation of corresponding variables. Calculate indicators as much as possible as part of the daily work routine. |
| **Technology independence** | Applications are independent of specific technology choices and therefore can operate on a variety of technology platforms. |
| **Use routine data whenever possible** | Explore all possibilities of exploiting a HIS for conducting, or facilitating, research studies. Regard, and treat, sample surveys and related studies as components of a general HIS. |

# Annex 7: sample proposal scoring matrix

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **Company Name** |
|  |  | **Max**  | **1** | **2** | **3** | **4** | **5** |
| **Proposed Solution** |  |   |   |   |   |   |
|  | The proposal successfully communicates a good understanding of the project goals. |  **15**  |  |  |  |  |  |
|  | The proposal communicates an understanding of the project structure and localities. |  **15**  |  |  |  |  |  |
|  | The proposed technical solution seems feasible. |  **25**  |  |  |  |  |  |
|  | The proposed technical solution is complete, addressing all the requirements outlined in the RFP. |  **25**  |  |  |  |  |  |
|  | The proposal presents a logical system of when and where different modes of communication technology will be used. (e.g. GPRS vs. SMS vs. wired internet) |  **10**  |  |  |  |  |  |
|  | The company proactively identified technical or functional challenges and proposed solutions. |  **10**  |  |  |  |  |  |
|  | **Total** |  **100**  |  |  |  |  |  |
| **Proposed Methodology, Work Plan, Timeline** |  |  |  |  |  |  |
|  | The proposed work plan fits roughly within the timeline.  |  **20**  |  |  |  |  |  |
|  | The proposed work plan includes ample time for project requirements definition and design  |  **10**  |  |  |  |  |  |
|  | The proposed methodology reflects an approach of high communication with business owner and users. |  **20**  |  |  |  |  |  |
|  | The proposed work plan includes time for testing/feedback/iterative development. |  **10**  |  |  |  |  |  |
|  | The proposal includes all of the key deliverables listed as required in the RFP. |  **10**  |  |  |  |  |  |
|  | The vendor proactively identified issues and risks to the proposed work plan/timeline and offered solutions to mitigate them. |  **20**  |  |  |  |  |  |
|  | The proposal reflects the requirements stated in the RFP related to warranty, pilot support, and maintenance contracts. |  **10**  |  |  |  |  |  |
|  | **Total** |  **100**  |  |  |  |  |  |
| **Organizational Capabilities** |  |  |  |  |  |  |
|  | Programming and computing capabilities with required architecture, languages and tools is evident (Python, .NET, C/C#, Java, SQL) |  **20**  |  |  |  |  |  |
|  | The proposal refers to previous work that is relevant to our project methods and goals.  |  **15**  |  |  |  |  |  |
|  | Sufficient staff is proposed who have appropriate skills and experience. |  **20**  |  |  |  |  |  |
|  | The proposal contains guarantees for documentation, maintenance, warranty, and ownership transfer. |  **15**  |  |  |  |  |  |
|  | The quality of the written proposal indicates the company's ability to document appropriately and communicate in the language of interest. |  **20**  |  |  |  |  |  |
|  | The proposal provides some evidence that the company has experience working with organizations similar to your own. |  **10**  |  |  |  |  |  |
|  | **Total** |  **100**  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| **Grand Totals** |  **300**  |  |  |  |  |  |
| **Proposed Project Cost** |  |  |  |  |  |  |
|  | The proposed terms and conditions are reasonable and acceptable under contracting policies |  |  |  |  |  |  |
| **Other** |  |  |  |  |  |  |
|  | Level of effort - total work identified in proposals (in days) |  |  |  |  |  |  |

# Annex 8. Vendor Questions

| **Question** | **Reasoning** |
| --- | --- |
| * What is your largest implementation? How many users? How many records in the database?
 | Determine if the vendor has experience or evidence that they are able to support the size of your desired implementation. |
| * How many users can use the system at the same time?
 | If your users typically access the system and provide all of their reports on Friday afternoons, you do not want the system to fail or have very poor performance. |
| * What components of the proposed platform are proprietary? What components use commercial off-the-shelf software (COTS)? What components are open source?
 | To follow a principle such as technology independence, knowing the licensing requirements early is important. For system maintenance, knowing the underlying technology and corresponding robustness of either the software provider or the open source community can be important. |
| * What service level agreement for "up time" do you guarantee each month? How many hours of maintenance is the system unavailable each month and when are those typically scheduled?
 | What amount of time is tolerable for the system to be unavailable? 95% uptime translates to 8 hours each week. Usually the vendor will apply security updates to the software on your behalf. Yet, you would not want this to occur during key periods of system use. |
| * Where do you host the application?
 | Modern data centers have… |
| * How would you integrate with our HMIS? Can you provide examples of how you have done this before?
 | If an integrated system is a key principle, knowing that the application has a demonstrated architecture for data exchange is necessary. If the integration has never been done before, it may be considered an unsupported customization that requires ongoing maintenance fees. |
| * How do you safeguard the security and privacy of our data? What were the results of your most recent external audit?
 |  |
| * How often would our data be backed up? Can you provide us your disaster recovery plans? When was the last exercise and results?
 | If data is an asset, knowing that the vendor has processes to store and restore your system in the event of an emergency is important.  |
| * What training and support services do you provide? What hours is support available?
 | Clarifying roles and responsibilities for deploying the software early is needed to understand the overall costs. Training the users is often a large part of the deployment budget. Sometimes the vendor will provide training for administrators and train your trainers. Do your normal hours of operation coincide with the support hours provided?  |
| * What languages does your application support?
 | For ease of use, the system user interface should be in a language of your users. If the language is not currently supported, ideally the vendor has capabilities that allow you to localize the various terms. |
| * What is the annual maintenance and licensing fee? How much is this expected to increase annually?
 | Sometimes hidden fees obscure the true costs of the system. Maintenance fees of upwards of twenty percent of the software license may be required when the contract is signed.  |

# Annex 9 what drives costs in all phases of the project life-cycle?

| **Category** | **Cost drivers** |
| --- | --- |
| Governance | Number of trips and meetings |
| Management | Headcount, salary, and travel expensesMix of local versus international technical assistance |
| Development |  |
| Software and Interfaces – Configuring the environment, customizing modules, and developing interfaces to other parts of the health system take time and money in addition to any fees incurred for software licensing.  | Number of user requirements or stories to be developedLicensing costs per environment (production, test, training)Licensing costs per userNumber of interfaces required and level of effort |
| Content, Standards, and Localization –If the system is not already available in the local language, some costs may be incurred to modify documentation and the user interface.  | Number of additional languages not currently supported |
| Deployment |  |
| Client Hardware –Includes components such as computers, printers, scanners. If the system will be using mobile devices, need to determine if existing hardware can used, or if will new mobile devices will need to be purchased.  | Number of users on :* Desktop computers
* Mobile devices

Cost and availability of data connectivity and power |
| Training – The cost of developing and delivering training to the staff in the appropriate language. Includes ongoing training for software updates and to address the needs of new users. Includes the per diems supplied to individuals taking the trainees, transportation costs of bringing individuals to the training events, and facility fees.  | Number of users to be trainedDays of training per userDays of refresher training per year  |
| Operations |  |
| Data and Communication Services - Voice and data services to support the data and communication flow.  | Internet connectivityMonthly mobile data planExpected minutes and data use per userNumber of text messages |
| Hardware maintenance and replacement- desktop computers need to be upgraded and maintained, lost or stolen mobile devices will need to be replaced, etc. | Number of hardware devices Replacement rateMaintenance costs per device |
| Server Management and Hosting –The cost of internal and external support needed to support the system for both software and hardware problems and maintenance. | Data center setupCurrently supported hardware and software infrastructureService levelsSoftware and hardware maintenance fees |
| Administration and Call Center Support –In order for local individuals to manage day-to-day operations, there is often an administrator training that allows a small group to configure and modify the system. | Expected percentage of support callsCall center staffing hoursAdditional support staff required at the national and sub-national levelEquipment replacement percentageStaff turnover |

# Annex 10 TCO Budget matrix

The table below can be used to summarize costs across categories.

| **Budgeting Category** | **Year 0(initial launch)** | **Year 1** | **Year 2** | **Year 3** |
| --- | --- | --- | --- | --- |
| **Governance** |
| Meetings and administrative support |  |  |  |  |
| **Management** |
| Overall project management |  |  |  |  |
| Research, monitoring, and evaluation |  |  |  |  |
| **Development** |
| Software and interfaces |  |  |  |  |
| Content, standards, and localization |  |  |  |  |
| **Deployment** |
| Client hardware |  |  |  |  |
| Training |  |  |  |  |
| **Operations** |
| Data and communication services |  |  |  |  |
| Server management and hosting |  |  |  |  |
| Administration and call center support |  |  |  |  |
| **Total** |  |  |  |  |

✍ **Note**: *Ideally,* *costs of international support decrease over time with a corresponding increase in local health systems strengthening.*

# Annex 11 Sample Work Plan

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| # | Activity |  |  |  |  |  |  |  |  |  |
| 1 | **Planning** | **Milestone 1** | **Milestone 2** | **Etc.** |  |  |  |  |  |  |
| 1.1 | Define outcomes and form health vision | X |  |  |  |  |  |  |  |  |
| 1.2 | Negotiate the scope of project | X |  |  |  |  |  |  |  |  |
| 1.3 | Establish project charter and governance | X |  |  |  |  |  |  |  |  |
|  | ***Milestone review*** | X |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 1.4 | Form initial team |  | X |  |  |  |  |  |  |  |
| 1.5 | Define requirements and expected results through user involvement  |  | X |  |  |  |  |  |  |  |
| 1.6 | Find the right solution*Seek evidence and lessons learned from similar projects* |  | X |  |  |  |  |  |  |  |
| 1.7 | Establish budget |  | X |  |  |  |  |  |  |  |
| 1.8 | Develop draft implementation plan |  | X |  |  |  |  |  |  |  |
|  | ***Milestone review*** |  | **X** |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 1.9 | Post additional positions  |  |  | X |  |  |  |  |  |  |
| 1.10 | Hire and/or obtain short- term technical assistance |  |  | X |  |  |  |  |  |  |
| 1.11 | Select the right vendor(s)  |  |  | X |  |  |  |  |  |  |
| 1.12 | Negotiate/finalize vendor contract |  |  | X |  |  |  |  |  |  |
|  | ***Milestone review*** |  |  | **X** |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 1.13 | Finalize implementation plan |  |  | X |  |  |  |  |  |  |
| 1.14 | Finalize monitoring and evaluation plan |  |  | X |  |  |  |  |  |  |
| 1.15 | Draft communication plan |  |  | X |  |  |  |  |  |  |
|  | ***Milestone review*** |  |  | **X** |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 2 | **Management and Communications** |  |  |  |  |  |  |  |  |  |
|  | *Schedule the following items…* |  |  |  |  |  |  |  |  |  |
| 2.1 | Project manager progress reports  |  | X | X | X | X | X | X | X | X |
| 2.2 | Working group meetings  |  | X | X | X | X | X | X | X | X |
| 2.3 | Updates for senior management | X | X | X | X | X | X | X | X | X |
| 2.4 | Governance committee meetings | X | X | X | X | X | X | X | X | X |
| 2.5 | Communication to organization |  |  | X | X | X | X | X | X | X |
| 3 | **Development** |  |  |  |  |  |  |  |  |  |
| 3.1 | ***Hold project kickoff meeting*** |  |  |  | **X** |  |  |  |  |  |
| 3.2 | Establish risk and change management plan |  |  |  | X |  |  |  |  |  |
| 3.3 | Perform gap analysis |  |  |  | X |  |  |  |  |  |
| 3.4 | Finalize technical protocols, standards and operating systems |  |  |  | X |  |  |  |  |  |
| 3.5 | Re-design processes and tools for optimization |  |  |  | X |  |  |  |  |  |
| 3.6 | Design training programs |  |  |  | X |  |  |  |  |  |
| 3.7 | Obtain approval for new processes, tools, and training plan |  |  |  | X |  |  |  |  |  |
| 3.8 | Finalize training strategy and plan |  |  |  | X |  |  |  |  |  |
|  | ***Milestone Review*** |  |  |  | ***X*** |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 3.9 | Complete capacity sizing and needs assessment |  |  |  |  | X |  |  |  |  |
| 3.10 | Gather accurate performance data for existing systems and processes |  |  |  |  | X |  |  |  |  |
| 3.11 | Establish data center and hosting environment as needed |  |  |  |  | X |  |  |  |  |
| 3.12 | Install and configure server environment |  |  |  |  | X |  |  |  |  |
| 3.13 | Test integrations |  |  |  |  | X |  |  |  |  |
| 3.14 | Prepare user acceptance testing scripts |  |  |  |  | X |  |  |  |  |
|  | ***Milestone Review*** |  |  |  |  | ***X*** |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 3.15 | Set up call center and train support staff |  |  |  |  |  | X |  |  |  |
| 3.16 | Perform user acceptance testing |  |  |  |  |  | X |  |  |  |
| 3.17 | Resolve high and medium-level issues |  |  |  |  |  | X |  |  |  |
|  | ***Milestone Review and Sign Off on Phase*** |  |  |  |  |  | ***X*** |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 4 | **Deployment** |  |  |  |  |  | **X** |  |  |  |
| 4.1 | Procure items (might be staggered based on rollout strategy) |  |  |  |  |  | X |  |  |  |
| 4.2 | Print updated tools |  |  |  |  |  | X |  |  |  |
|  | ***Milestone Review*** |  |  |  |  |  | ***X*** |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 4.3 | Execute communication plan at sub-national level, districts, and health facilities |  |  |  |  |  | X |  |  |  |
| *4.4* | ***Pilot*** |  |  |  |  |  |  |  |  |  |
| 4.4.1 | Prepare implementation checklist |  |  |  |  |  |  | X |  |  |
| 4.4.2 | Install network infrastructure (telecommunications and power) |  |  |  |  |  |  | X |  |  |
| 4.4.3 | Install hardware and software at pilot sites |  |  |  |  |  |  | X |  |  |
| 4.4.5 | Provide updated tools, as necessary |  |  |  |  |  |  | X |  |  |
| 4.4.6 | Pilot test processes, tools, and technology |  |  |  |  |  |  | X |  |  |
| 4.4.7 | Resolve high and medium-level issues, modify configuration as necessary |  |  |  |  |  |  | X |  |  |
| 4.4.8 | Revise implementation checklist and training |  |  |  |  |  |  | X |  |  |
|  | ***Milestone Review*** |  |  |  |  |  |  | ***X*** |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| *4.5* | ***Rollout*** |  |  |  |  |  |  |  |  |  |
| 4.5.1 | Install hardware and software |  |  |  |  |  |  |  | X |  |
| 4.5.2 | Deploy new tools |  |  |  |  |  |  |  | X |  |
| 4.5.3 | Execute training for revised processes, tools, and technology |  |  |  |  |  |  |  | X |  |
|  | ***Milestone Review****(Repeat above for each rollout cycle)* |  |  |  |  |  |  |  | ***X*** |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 5 | **Operations** |  |  |  |  |  |  |  |  |  |
| 5.1 | Implement monitoring process and tools |  |  |  |  |  |  |  |  | X |
| 5.2 | Finalize service level agreements and maintenance contracts |  |  |  |  |  |  |  |  | X |
| 5.3 | Establish backup procedures |  |  |  |  |  |  |  |  | X |
| 5.4 | Monitor use and maintenance needs |  |  |  |  |  |  |  |  | X |
| 5.5 | Evaluate system performance |  |  |  |  |  |  |  |  | X |
|  | ***Milestone Review*** |  |  |  |  |  |  |  |  | ***X*** |

# Annex 12. Understanding technology jargon

|  |  |
| --- | --- |
| CRDM | Collaborative Requirements Development Methodology.  |
| eHealth | Electronic health. Referring to the use of computer systems, electronic processes and communication to support health care programs. <http://en.wikipedia.org/wiki/EHealth> |
| ICT | Information and communication technology |
| mHealth | Mobile health. Also written as m-health. A term used for the practice of medicine and public health, supported by mobile devices. <http://en.wikipedia.org/wiki/Mhealth>  |
|  |  |

# Annex 13: Finding more information

1. <http://www.who.int/immunization_delivery/optimize/en/>

 or <http://www.path.org/projects/project-optimize.php> [↑](#endnote-ref-2)
2. More Information on Project Optimize

 <http://www.who.int/ehealth/en/>

World Health Organization and International Telecommunication Union. (2012). *National eHealth strategy toolkit*. Geneva: WHO Press. [↑](#endnote-ref-3)
3. <http://deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/GuidImplCLMIS.pdf>

Excellent toolkit by JSI, which partially overlaps with this document. [↑](#endnote-ref-4)
4. <http://www.path.org/publications/files/TS_opt_vision_2020.pdf> [↑](#endnote-ref-5)
5. <http://mediacentre.dh.gov.uk/2011/09/22/dismantling-the-nhs-national-programme-for-it>

<http://www.nao.org.uk/publications/1012/npfit.aspx> [↑](#endnote-ref-6)
6. Braniff, L., & Faz, X. (2012) Information systems: Implementation guidelines. CGAP. Retrieved from <http://www.cgap.org/publications/information-systems-technical-guide> [↑](#endnote-ref-7)
7. Public Health Informatics Institute. (2011). [↑](#endnote-ref-8)
8. World Health Organization and International Telecommunication Union. (2012). *National eHealth strategy toolkit*. Geneva: WHO Press. [↑](#endnote-ref-9)
9. Adapted from “Prioritizing Clinical Information System Project Risk Factors: A Delphi Study”. Guy Paré et al. [↑](#endnote-ref-10)
10. Adapted from <http://www.jointlearningnetwork.org/content/what-crdm> [↑](#endnote-ref-11)