# The Case for Developing and Deploying an Open Source Electronic Logistics Management Information System

White Paper

THE ROCKEFELLER FOUNDATION

PATH

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# Acknowledgements

# Overview

Over the past three decades, PATH has honed an effective approach to catalyzing innovation of health technologies based on user-driven design and public-private partnerships. In June 2009, PATH received a grant from The Rockefeller Foundation to apply this approach and experience to create a repeatable methodology for designing health information systems (HIS) for public health programs in the world's poorest countries. In partnership with the Public Health Informatics Institute, a methodology was adapted to determine and document user requirements called Collaborative Requirements Development Methodology (CRDM). CRDM, built on previous efforts by the World Health Organization (WHO) and other groups, was designed to be applied across the spectrum of health care domains, including supply chains and logistics.

In September 2010, PATH released the *Common Requirements for Logistics Management Information Systems.* This document described the outcome of applying CDRM to strengthen logistics management systems for pharmaceuticals, vaccines, and medical products. With support from John Snow Inc. (JSI) and the US Agency for International Development (USAID), Zambia and Tanzania applied this methodology to produce a localized version of user requirements for a national logistics management information systems (LMIS). Having a methodology and a set of common requirements enabled Zambia and Tanzania to move rapidly to sourcing a solution to meet these requirements. Although these two countries worked independently to determine their own user requirements, they concluded that they shared a large percentage of the same requirements and were seeking solutions that were nearly identical.

Three important conclusions can be drawn from this project. First, health information users and stakeholders in low- and middle-income countries can be successfully engaged in the application of an appropriate methodology to determine requirements for a health information system. Second, countries can use those requirements to plan, secure funding, and source a solution that meets those requirements. Third, requirements related to supply chains are more alike than different across countries, and the common LMIS requirements have value to many as a public good. What is now needed is a coordinated effort to produce solutions that will meet the user requirements shared by multiple countries. The call to action is the creation of shared, repeatable solutions that will enable countries to efficiently and effectively deploy systems to improve supply chain performance. Zambia and Tanzania have already shown that they need the same solution, which will likely be appropriate for other countries as well.

OpenLMIS was formed by VillageReach, JSI, and PATH with funding from The Rockefeller Foundation in part to help countries strengthen their logistics systems by providing a global commons for sharing tools, experience, and best practices. OpenLMIS presents an opportunity to rapidly move this work forward if work on common solutions can be easily shared as public goods for any country to have access to. The confluence of recent leadership changes and learning in multiple countries combined with the call by donors and stakeholders to improve the delivery of vaccines, pharmaceuticals, health commodities,

and diagnostics make this an ideal time for moving forward. The knowledge and resources exist to solve this problem.

## Summary of Efforts to Strengthen Health Information Systems

Since 2004, efforts to strengthen health information systems in more than 66 low- and lower-middle-income countries (LMICs) have attracted significant attention largely because of funding made available by the Bill & Melinda Gates Foundation through WHO and by The Rockefeller Foundation. Figure 1 is a high-level timeline of major activities over the past 6 years, with emphasis on the last 24 months of work on LMIS.

Figure 1. Major activities to strengthen health information systems in developing countries, 2004 to 2011.
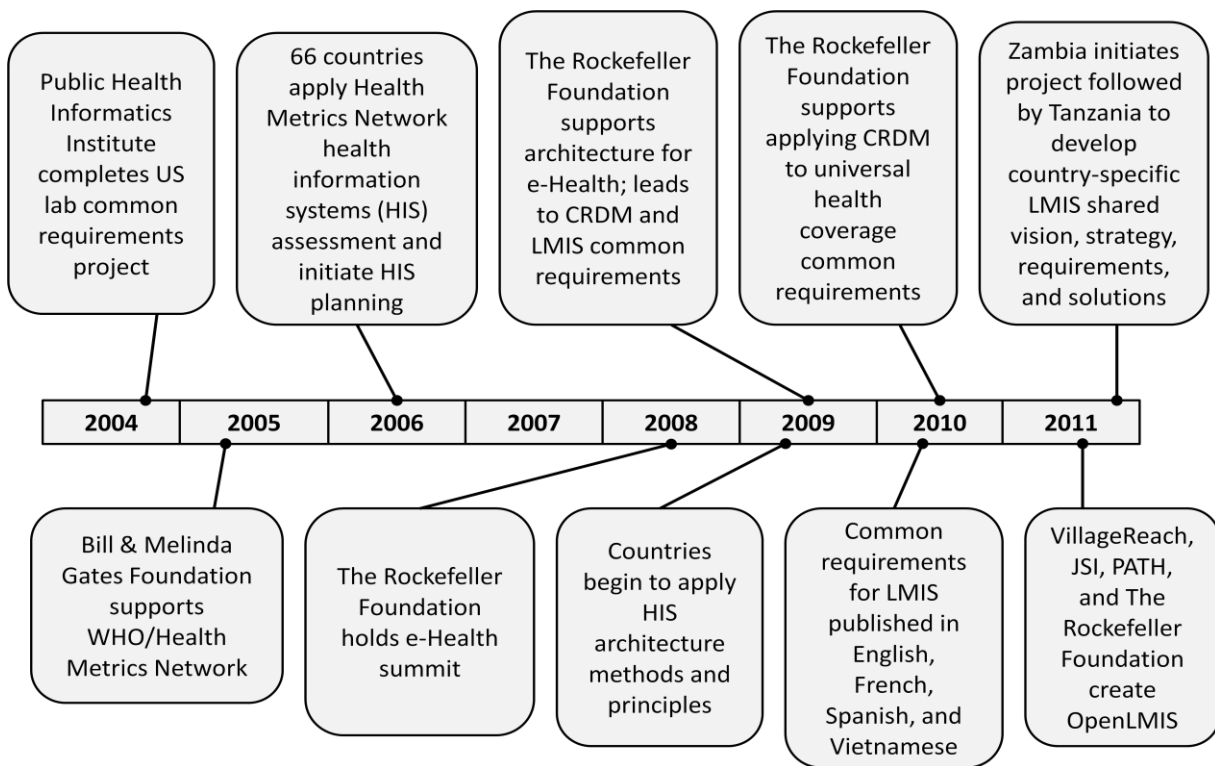


Many global and country leaders, managers, and stakeholders have been involved in strengthening health information systems, especially LMIS. Much of this work is not reflected in Figure 1. One example is the work of the Pan American Health Organization and Partners in Health in Haiti. This extensive base of knowledge and experience has contributed to a deeper understanding of root challenges and conditions of success for scalable and sustainable solutions as well as a deep sense of urgency by countries to strengthen their health information systems. One of the root challenges has been the lack of a systematic methodology to develop a national health information system strategy, align donors and stakeholders around it, and determine and document requirements to implement it.

# A Collaborative Approach for Aligning Stakeholders, Country Leaders, and Users of Health Information

Global health and development in LMICs involves many global, regional, and local stakeholders, donors, and leaders. A fundamental challenge is aligning these actors to address health system needs systematically in a shared and collaborative way. Currently, each donor-funded project addresses a specific program need and geography with interventions and information systems designed only to support the specific program and meet the requirements of that donor. It is common for a single donor to have multiple projects in a country that are equally fragmented.

Figure 2 illustrates a conceptual model for how strategy is the work of senior leaders and stakeholders and is the foundation for information systems and technologies that will ultimately help implement it. This is often not the case today. It is common for donors and their technical implementing recipients to skip aligning to a national strategy, referred to as business architecture, and choose a phone or m-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. Organizations across the world in the commercial and public sectors have realized that applying a systematic and rational approach is the only way to increase the likelihood of effective management and sustainability of information systems.

Figure 2. Strategy and tactics for building information systems.
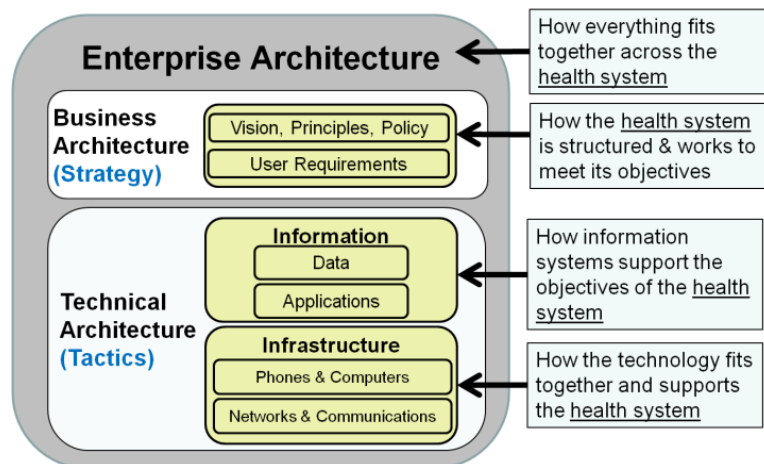


Responding to this root challenge was one of the initial objectives of a project funded by The Rockefeller Foundation in 2009 and led by PATH, to adapt a collaborative methodology to align stakeholders and country leaders with a shared vision for health information systems. The Public Health Informatics Institute drew upon more than ten years of experience in US public health informatics to help develop what became known as collaborative requirements development methodology (CRDM). This methodology includes a facilitated set of steps that engage stakeholders and empower country leaders to articulate and endorse a shared vision and strategy. Kenya, Rwanda, Senegal, and Vietnam were early contributors to adapt and contribute to CRDM to produce a methodology that could be used by any country for any health information system.

# Globally Driven Effort to Create Common and Shared Requirements for Logistics Management Information Systems

A health information system (HIS) consists of multiple functional domains each representing a set of closely aligned activities. In September 2008, WHO supported a technical consultation in Seattle to draft an HIS domain framework. This effort produced a set of ten domains that were documented in a white paper by Stansfield et al., titled *The Case for a National Health Information System Architecture: A Missing Link to Guiding National Development and Implementation,* which was published by WHO in 2008. Table 1 outlines the ten domains.

Table 1. Ten domains of activity to be covered by health information systems.

| | Domain name | Sample processes | Typical users |
|---|---|---|---|
| 1. | Community-based services | Patient registry<br>Birth and death registry<br>Migration (in and out)<br>Disease surveillance | Community health worker<br>Community leader<br>District medical officer<br>Trained birth attendant |
| 2. | Facility-based services | Patient registry<br>Birth and death registry<br>Classification of disease, symptoms, and procedures<br>Disease surveillance | Patient/guardian/parent<br>Chief health officer<br>Physician<br>Nurse<br>District health manager<br>Health program manager |
| 3. | Laboratory and diagnostic services | Specimen collection<br>Test processing<br>Test results reporting<br>Disease surveillance<br>Classification of disease | Laboratory technician<br>Chief health officer<br>Physician<br>Nurse<br>Surveillance officer |
| 4. | Supply chain and logistics | Stock inventory management<br>Stock demand forecasting<br>Stock requisitions<br>Stock order processing<br>Stock distribution<br>Stock receiving | Pharmacist<br>Warehouse and store  manager<br>Chief health officer<br>Facility health manager<br>District health manager |
| 5. | Human resource management | Recruitment and hiring<br>Staff scheduling and duty rosters<br>Workforce monitoring<br>Workforce training and credentialing | National health manager<br>National finance manager<br>Provincial health manager<br>District health manager<br>Facility health manager |
| 6. | Environmental devices and management | Water quality and access mapping<br>Sanitation resources and access mapping<br>Routine environmental monitoring<br>Event reporting and response | Chief health officer<br>Physician<br>District health manager<br>Provincial health manager<br>National surveillance officer |
| 7. | Health System management and stewardship | Data collection and reporting<br>Data analysis and decision support<br>Budget and expenditure reporting<br>Monitoring of urgent health events<br>Disease detection and reporting<br>Monitoring and evaluation reporting | Chief health officer<br>District medical officer<br>Provincial medical officer<br>National monitoring and evaluation officer |

| | Domain name | Sample processes | Typical users |
|---|---|---|---|
| 8. | Health finance and insurance | Beneficiary enrollment<br>Beneficiary eligibility verification<br>Beneficiary fee and premium collection<br>Claim processing and payment<br>Fund budgeting, expenditure, and revenue tracking | Health finance officer<br>Chief health officer<br>District health manager<br>Provincial health manager |
| 9. | Knowledge management, decision support, and information resource management | Access clinical protocols<br>Access to research and authoritative source materials<br>Access job aids<br>Deliver and manage training content | Chief health officer<br>Community health worker<br>Physician<br>National director of nursing<br>National health manager<br>Facility manager |
| 10. | Infrastructure resource management | Track and manage physical assets<br>Budget maintenance and replacement<br>Procurement planning | National health director<br>Provincial health manager<br>District health manager<br>Facility manager |

The domain of supply chain and logistics has been a significant challenge to many health systems. Use of the CRDM approach helped to create a shared vision and common requirements for LMIS across Kenya, Rwanda, Senegal, and Vietnam. This resulted in the publication in September 2010 of the *Common Requirements for Logistics Management Information Systems* authored by PATH. Published in English, French, Spanish, and Vietnamese, this document is available at www.path.org and www.openlmis.org. The purpose of this publication was to provide countries with a starting point to develop their own national vision, strategy, and requirements for an LMIS.

Figure 3 depicts a 2x2 matrix that illustrates global goods that can be shared by all and country-specific work needed to solve country problems. The common requirements are represented in Quadrant 1; these are global common architecture goods that are available to any country. Quadrant 2 is where countries undertake their own project to adapt and refine the common requirements into a version that meets their specific needs, including the alignment of local stakeholders to a shared vision and strategy as well as requirements.

Figure 3. Matrix of global and country-specific architecture and solutions.
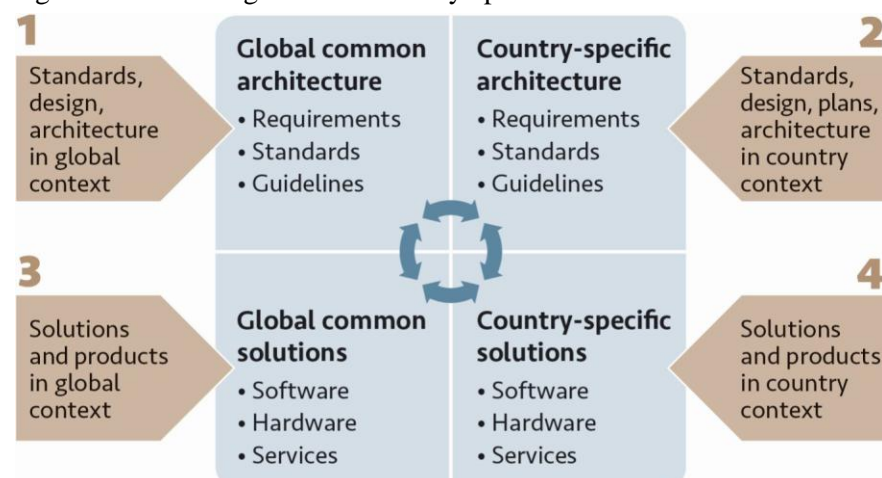
Global solutions represented by Quadrant 3 benefit from multiple sets of requirements and result in solutions that are intentionally reusable for more than one country. This represents the best example of leveraging "other people's money" OPM. Solutions designed for a single country, as represented in Quadrant 4, may meet this country's requirements quite well but require that the full cost be covered by this single effort. Although solutions designed for a single country exist in Quadrant 4 in order to be useful to others, the extra investment needed for documentation, training materials, and design is often beyond the budget and interest of the country.

## Country-Driven Efforts to Create Specific Requirements for Logistics Management Information Systems

In collaboration with the Supply Chain Management System project and USAID|DELIVER, the Zambia Ministry of Health (MOH) initiated a project to strengthen the national LMIS and used the common requirements as a starting point. This enabled the local team to rapidly adapt and refine a set of requirements to address their specific context. The result is a shared vision and strategy for a computerized LMIS produced by the MOH and supported by requirements that describes what the LMIS must do to implement this strategy. The Tanzania Ministry of Health and Social Welfare also initiated a project to strengthen the country's LMIS. Tanzania also applied CRDM to develop a shared vision and strategy among local stakeholders supported by shared and locally derived requirements.

Strong themes have emerged from the work of these two countries. One is that there is much greater clarity about the processes that fall under the responsibility of the central stores functional unit. This is Medical Stores Limited in Zambia and Medical Supply Division in Tanzania. Both are parastatals that receive products from manufacturers and wholesalers inside and outside the country and then store and distribute these products. They also need to manage orders and pick, pack, and ship products to lower-level facilities. LMIS involves the processes needed to produce orders for products from higher central and intermediate stores as well as the tracking of products from the point of departure at the central store to the service delivery point. The actual consumption of products is important for the LMIS to capture, although it does not support the management of clinical pharmacy processes, which may be part of a clinical record-keeping system or patient management system.

Another strong theme is the emergence of consistent scenarios that describe LMIS use and reach. Three scenarios have emerged, as illustrated in Figure 4 on the following page.

Figure 4. A three-phase road map for LMIS implementation and reach.



Phase 1: Deploy at the central level, migrate historical logistics data, and aggregate all requisitions and reporting forms for all products and all programs from all service delivery points into LMIS.

Phase 2: In addition to Phase 1, Phase 2 extends LMIS to districts and hospitals for online access to LMIS for order tracking and reporting.

Phase 3: In addition to Phase 2, Phase 3 extends LMIS to service delivery points for direct entry of requisition and reporting forms and online access to LMIS for order tracking and reporting.

Phase 1 has been identified as the top priority for both Zambia and Tanzania. The requirements for this phase are also consistent in that the LMIS needs to aggregate information on products from many sources and be able to transform these data into orders to be filled by Medical Supply Division or Medical Stores Limited. The LMIS in Phase 1 needs to accept data for all products, which may include 800 to 2,000 discrete products, as well as track current inventory at all levels and allow access to this information by decision-makers. The LMIS also needs to provide access to information to support forecasting, supply planning, and procurement processes. This scenario is characterized as having relatively few operational users who are entering, validating, analyzing, and managing data. The number of information users might be quite high because many decision-makers are currently involved in logistics planning, forecasting, ordering, and monitoring. Phase 1 includes the user and system requirements to ensure these decision-makers are well served.

Phase 2 involves a significant extension of the LMIS from the central level to districts and hospitals. This capability enables data to be captured sooner than in Phase 1 by providing electronic access to the LMIS. Phase 2 involves additional investment in network and computing infrastructure, training, and staffing. The benefits of Phase 2 include reducing the time for paper requisitions to be collected and entered centrally. Also, the district can benefit from the logic and business rules in the LMIS to correct and analyze requisitions in real time using the power of the LMIS for trend analysis and calculations.

Phase 3 provides the full extension of the LMIS to the service delivery level that is appropriate for the various levels of service and programs at each service delivery point. There are numerous examples of mobile solutions that are illustrating the potential to capture and transmit product information. These are impressive and promising but in most cases automate specific products and programs that mirror the

current segmented, fragmented, and inconsistent data formats found in paper today. The vision for the LMIS for both Zambia and Tanzania describes a future that includes consumption data and end-to-end logistics management that is enabled in Phase 3. Like Phase 2, this phase involves an even greater investment in infrastructure and staffing capacity-building.

Figure 5 presents a conceptual representation of what the LMIS would look like as described by Tanzania and Zambia. There are three main parts to the LMIS with number 1 being the core application and database capable of accepting and managing requisitions from any source and transmitting them to the warehouse management system to be converted into orders and shipments. Number 2 is the extension of the LMIS to the district level where requisitions are entered, analysis is completed, and approvals are made to convert the requisitions into orders. Number 3 is the full extension of the LMIS to the service delivery point for online requisitions and order tracking and receiving. Hospitals and larger health centers that have appropriate infrastructure and more inventory items to order, track, and receive may use web-based devices. Dispensaries handle fewer items and thus may benefit from mobile phone-based forms and short message service alerts for order tracking.
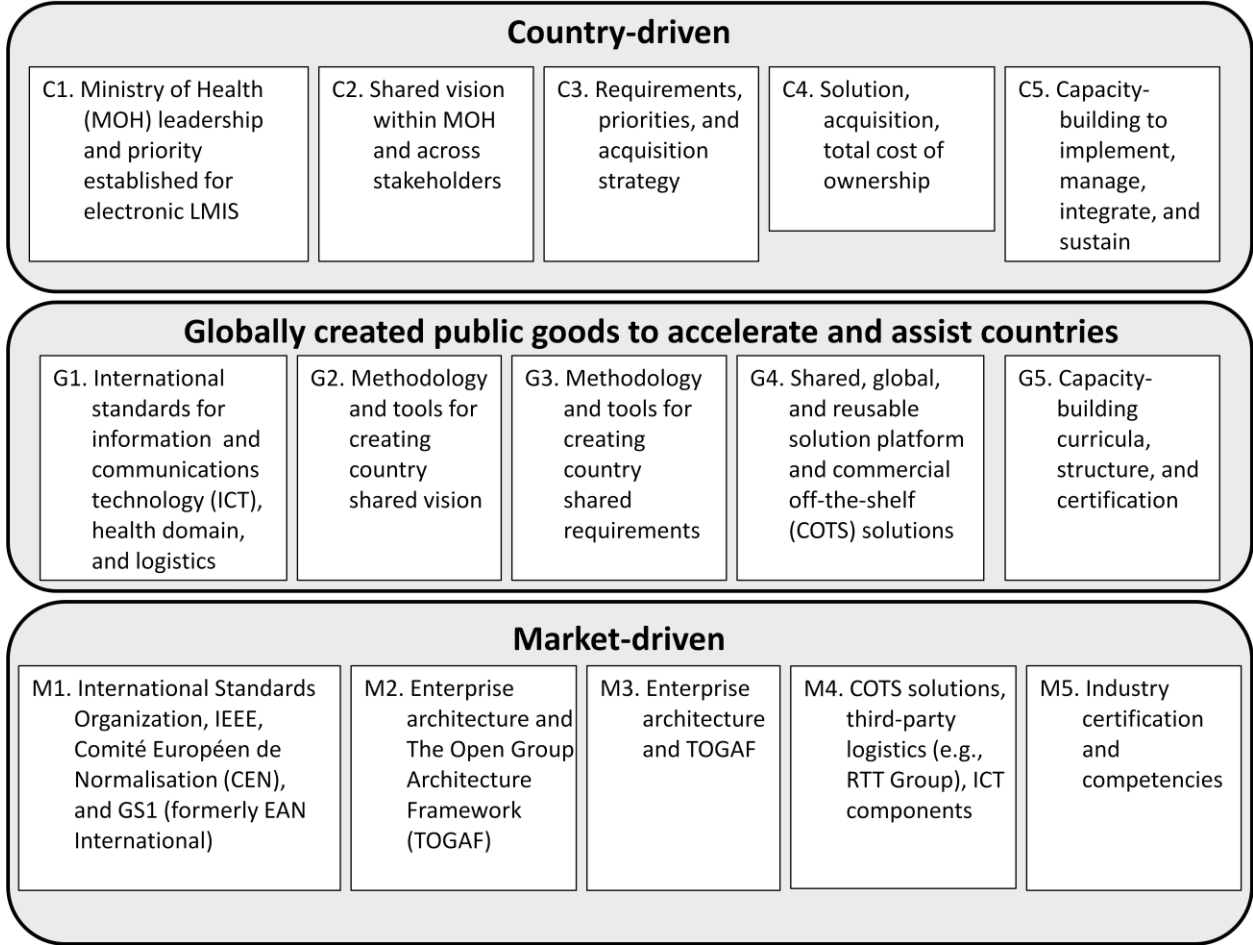
Figure 5. Conceptual functional model of a computerized LMIS.
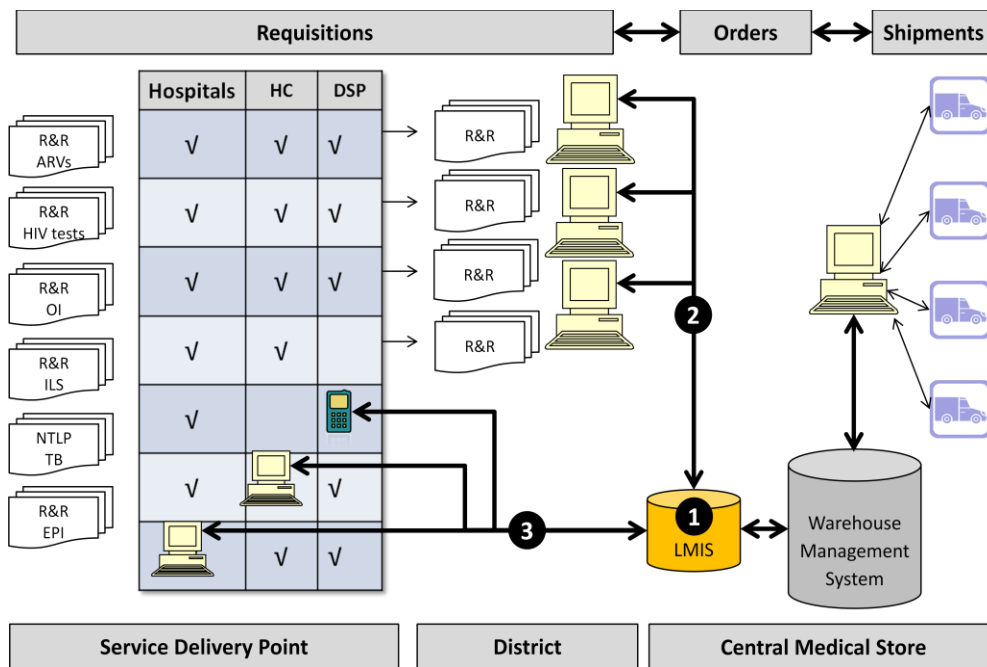
# OpenLMIS as a Global Commons to Bridge Between Country-Driven Design and Global Common and Shareable Solutions

There are many dimensions to effectively strengthening health information systems in LMICs. Figure 6 represents three complementary and essential work streams and their major activities to illustrate the diversity of activities and actors. These three work streams involve the work that is driven by countries, global stakeholders, and markets.

Figure 6. Three complementary and essential core work streams for strengthening country systems.

| Country-driven | | | | |
|---|---|---|---|---|
| C1. Ministry of Health (MOH) leadership and priority established for electronic LMIS | C2. Shared vision within MOH and across stakeholders | C3. Requirements, priorities, and acquisition strategy | C4. Solution, acquisition, total cost of ownership | C5. Capacity-building to implement, manage, integrate, and sustain |

| Globally created public goods to accelerate and assist countries | | | | |
|---|---|---|---|---|
| G1. International standards for information and communications technology (ICT), health domain, and logistics | G2. Methodology and tools for creating country shared vision | G3. Methodology and tools for creating country shared requirements | G4. Shared, global, and reusable solution platform and commercial off-the-shelf (COTS) solutions | G5. Capacity-building curricula, structure, and certification |

| Market-driven | | | | |
|---|---|---|---|---|
| M1. International Standards Organization, IEEE, Comité Européen de Normalisation (CEN), and GS1 (formerly EAN International) | M2. Enterprise architecture and The Open Group Architecture Framework (TOGAF) | M3. Enterprise architecture and TOGAF | M4. COTS solutions, third-party logistics (e.g., RTT Group), ICT components | M5. Industry certification and competencies |

Each of the three work streams contains a set of five representative activities represented by C for country, G for global and M for market. Creating and sustaining improvements to the health system starts with country-driven efforts because this is essential for local ownership and capacity which increase the likelihood of sustainability after the end of the "project" and the departure of donors. These five activities in the country work stream form a somewhat logical flow from C1 through C5. In the case of an LMIS, Tanzania and Zambia have recently demonstrated that having access to global requirements enabled and accelerated their efforts to develop their own vision and strategy (C2) and requirements (C3). Both are

now defining their strategy for sourcing a solution to find and implement a solution that will meet their country requirements.

Informing the sourcing strategy is a current market landscape assessment. The purpose of this assessment is to discover and analyze viable, affordable solutions against the country-determined requirements. So far, a viable solution that is a perfect fit has yet to be discovered. However, solutions that meet many country requirements and leverage open source principles have emerged as part of the landscape evaluation. These solutions show some promising attributes but were not designed for reuse across multiple countries. Commercial off-the-shelf (COTS) solutions emerging from enterprise resource planning providers meet some country requirements but have very high licensing costs, especially for deployment of Phase 2 and 3 (see Figure 4). Point-of-sale COTS solutions solve many requirements described in Phase 3 but have not been deployed in LMIC public health settings and involve significant investments in infrastructure, hardware, proprietary software licenses, support, and capacity-building and do not meet Phase 1 requirements—where delivering an LMIS solution that is viable and affordable remains an unmet need.

An LMIS that addresses the requirements of Phase 1 for Zambia and Tanzania would be of immediate value to these countries. It would likely be valuable to other countries as well. As the understanding of what is needed in the immediate term by these countries becomes clearer, the opportunity exists to have these countries drive the design and development of a shared LMIS solution. Potentially adding to the base of country-driven requirements is Ethiopia, which has developed its own LMIS over the past two years. Although Ethiopia has deployed the current version of the LMIS, there is interest in future development that would result in an LMIS that is more sustainable and better adapted to local requirements. Ethiopia's experience and requirements could be leveraged along with that of Zambia and Tanzania to form a shared set of requirements to design and develop an LMIS to deliver a solution that meets Phase 1.

The activities and relationships between country-driven work and global- and market-driven players is not the focus of this discussion as enabling and delivering on country-driven efforts is the priority today. This report responds directly to this priority but also recognizes that alignment with global players and leveraging market players is essential for solutions to be funded, sustainable, and continue to improve over time. PATH has demonstrated for over 30 years that alignment with global stakeholders, producing public goods, and leveraging market dynamics through public-private partnerships are key to achieving long-term success.

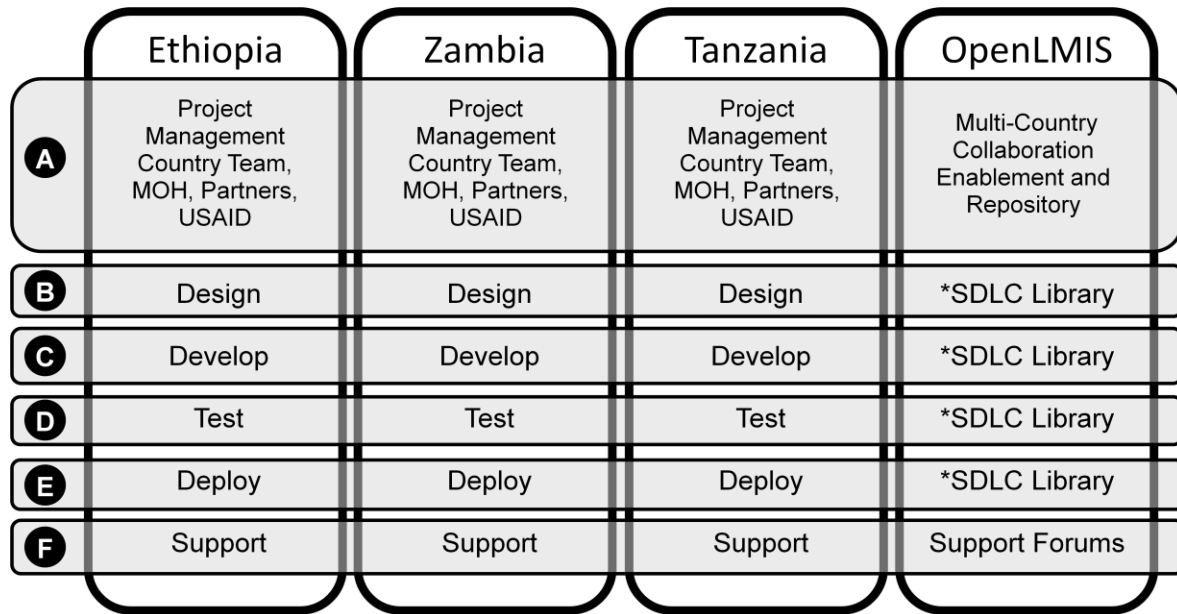# Conceptual Collaboration Model for Delivering an LMIS Solution

The conceptual collaboration model described in the following section illustrates how OpenLMIS might be a mechanism for a country-driven effort to design, develop, and deploy a common LMIS solution. Integral to this model are the leadership roles at the global and country levels. First, this effort requires a strong program manager at the global level to align donors, stakeholders, and technical advisors. This role also serves as the focal point for the three country project managers as well as the development manager of OpenLMIS. These additional roles at the country level and within OpenLMIS are essential. The day-to-day operational team is the global program manager (PM), Zambia PM, Tanzania PM, Ethiopia PM, and OpenLMIS development manager. The principal oversight role is filled by an OpenLMIS technical advisory group (TAG). An ad hoc and perhaps virtual stakeholder mechanism is formed by country leaders, local donors, global donors, and global technical agencies already engaged and funded in the business of health supply chain and logistics—namely, Supply Chain Management System and USAID|DELIVER.

This section outlines three models for country collaboration to develop an LMIS. Model 1 represents the highest degree of collaboration among countries as well as with OpenLMIS as a "country commons" to store and retrieve documents and tools.

## Model 1

Figure 7 depicts how Model 1 would work with the three countries that have emerged as *first-mover* collaborators based on work over the past six months and projected plans for 2012. This model includes a shared approach to project management, design, development, and testing. Deployment and support require a local focus, but this model enables sharing of best practices, tools, and methodologies. The text following Figure 7 further explains this model.

Figure 7. Model 1 for country collaboration.



| | Ethiopia | Zambia | Tanzania | OpenLMIS |
|---|---|---|---|---|
| **A** | Project Management Country Team, MOH, Partners, USAID | Project Management Country Team, MOH, Partners, USAID | Project Management Country Team, MOH, Partners, USAID | Multi-Country Collaboration Enablement and Repository |
| **B** | Design | Design | Design | *SDLC Library |
| **C** | Develop | Develop | Develop | *SDLC Library |
| **D** | Test | Test | Test | *SDLC Library |
| **E** | Deploy | Deploy | Deploy | *SDLC Library |
| **F** | Support | Support | Support | Support Forums |

*Software Development Life Cycle

Under Model 1, countries could collaborate and share as described below:

A.  Collaboration at the project management level has already begun among the three countries. In this model, the countries use common methodologies and approaches to managing the project and co-create a common work plan and work plan management tool. OpenLMIS would enhance collaboration by providing a "country commons" for the storage and management of common project management tools and potentially a shared project management plan.

B.  Design collaboration would include, at a minimum, the sharing of functional and system requirements, which has already begun among the three countries. The Software Development Life Cycle (SDLC) standard document templates for USAID-supported investments call for additional steps in the design phase; the software requirements specification document is one example of a required document. In this model, the countries would collaborate by agreeing on a common template and continue to participate in co-creation of the SDLC design phase. Although this work may be augmented by an external vendor that may be contracted by one or more of the countries, all work products would be shared and used for the development phase.

C.  Development would be focused on a common shared core software platform that would be clearly described in the SDLC design phase with each country collaborating to ensure its requirements are met. This is the most difficult part of Model 1 because each country depends on the performance of a shared development effort and may feel the least amount of control at this phase.

D.  The testing and quality assurance (QA) phase is an integral part of the SDLC and would differ from the shared development phase in an important way. Each country would have resources committed to
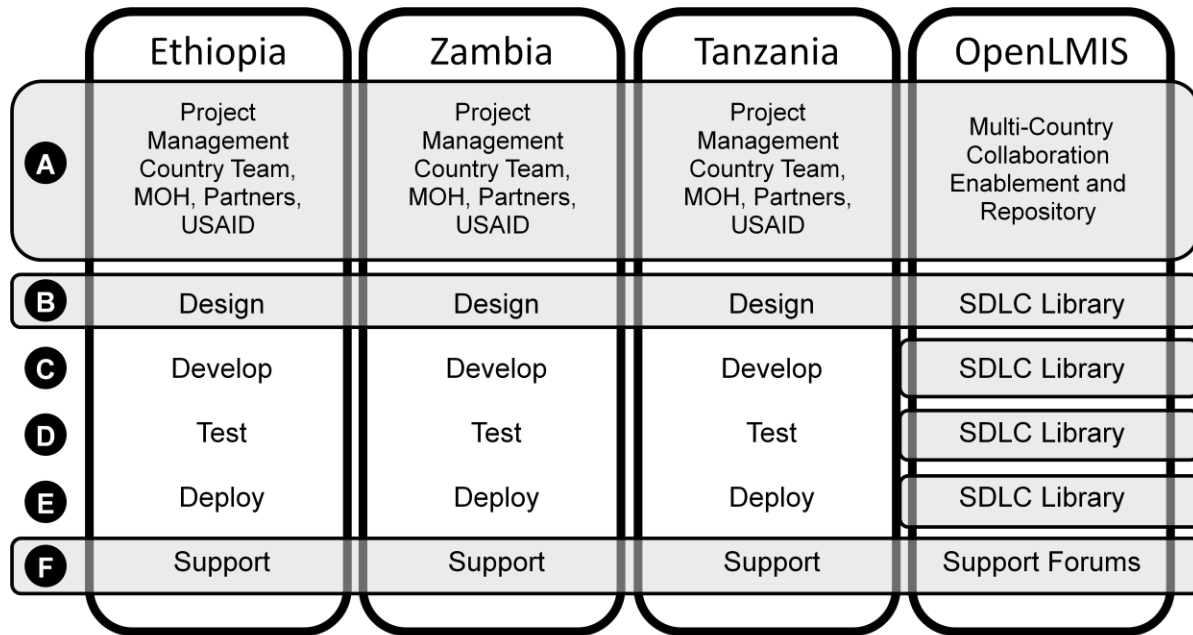
engage in the testing and QA phase. The activities of each country would be coordinated through open collaboration with each other as well as with the organization or vendor contracted to develop the software. Each country would independently ensure through testing and QA that its requirements are being met to the level of quality and performance needed throughout development. This becomes a critical country risk mitigation point through ensuring direct line of sight to all development activities and performance of the development vendor or organization. Further, collaboration among countries will ensure that each is exposed to all of the functionality of the core platform, including functions that may not have been deemed a high priority by one or two countries. In this way, each country may see how these "non-priority" functions that will be integral to the platform may benefit them.

E. Deployment activities need to be country specific because they must respond to conditions on the ground as well as to local capacity. Having countries share and learn from each other in the development of deployment plans as well as sharing common training curricula and methodologies should benefit all. Understanding and capturing the experience and lessons learned by the first countries deploying a core LMIS platform would be the role of OpenLMIS so that all countries that follow would benefit.

F. Support is similar to deployment in that each country would need to have an approach that is responsive to local conditions and capacity. However, as a result of using a common core platform, an easy-to-access, easy-to-use support forum could be provided for any country through OpenLMIS. This would enable countries to quickly learn about problems before they occur in their own country as well as to access solutions and guidance from peers who have already resolved problems. In addition, by having a common support forum, developers can be made aware of country experience and problems, not only to provide rapid response to software bugs but also to guide the development of minor enhancements as well as future major product releases.

## Model 2

Model 2 differs from Model 1 most significantly in that each country would pursue its own independent development, testing/QA, and deployment activities. OpenLMIS still provides for a "country commons" to store and retrieve documents and tools, which could include multiple reference models for LMIS as produced by collaborating countries and their partners. Figure 8 depicts how this model might work for Ethiopia, Tanzania, and Zambia.

Figure 8. Model 2 for country collaboration.



| | Ethiopia | Zambia | Tanzania | OpenLMIS |
|---|---|---|---|---|
| **A** | Project Management Country Team, MOH, Partners, USAID | Project Management Country Team, MOH, Partners, USAID | Project Management Country Team, MOH, Partners, USAID | Multi-Country Collaboration Enablement and Repository |
| **B** | Design | Design | Design | SDLC Library |
| **C** | Develop | Develop | Develop | SDLC Library |
| **D** | Test | Test | Test | SDLC Library |
| **E** | Deploy | Deploy | Deploy | SDLC Library |
| **F** | Support | Support | Support | Support Forums |

Under Model 2, countries could collaborate and share as outlined below:

A.  Collaboration at the project management level as described in Model 1 would continue. One major distinction of Model 2, however, is that each country would undertake development activity independently. There would still be value in country project management teams having a forum for sharing experiences and engaging in collaborative problem solving. OpenLMIS would enhance collaboration by providing a "country commons" for the storage and management of common project management tools and by providing a forum for sharing experiences and solving problems.

B.  Design collaboration would include, at a minimum, the sharing of functional and system requirements, as in Model 1. Completing the rest of the SDLC standard document templates would most likely evolve independently as each country either contracts a vendor for external development or builds its internal development team, which would most likely share in the work to produce these documents. OpenLMIS could still serve as the "country commons" for the sharing of the SDLC template library as well as examples of best practices for completed SDLC documents to serve as references for any country teams.

C.  Development as discussed above would be undertaken independently by each country team and its partners. OpenLMIS would continue to serve as a "country commons" for storing and sharing the SDLC library of associated artifacts, which could include the actual LMIS software products resulting from country projects. In contrast to Model 1, Model 2 provides the highest degree of control within each country team because development is completely within their control. It also requires each
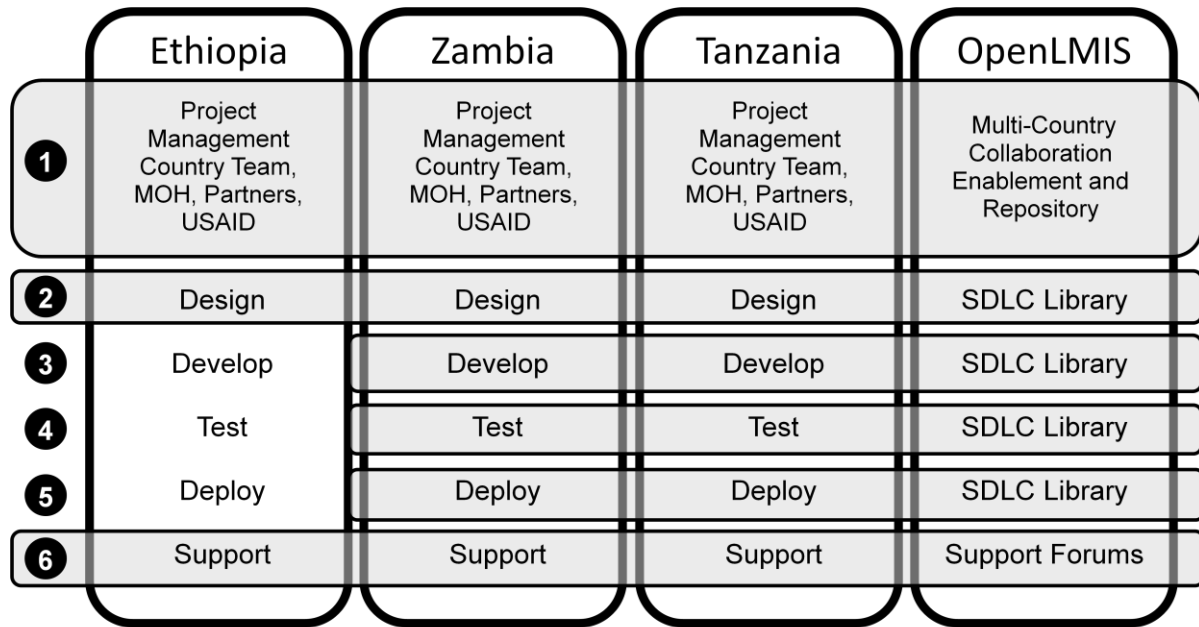
country to bear the full cost of development phase activities.

D. The testing and QA phase would be independently handled by each country although common methodologies and guidelines would be available through the OpenLMIS repository. Country experience would contribute to and improve these methodologies.

E. Deployment activities would also be completely independent but would likely benefit from shared templates and guidelines placed into the "country commons."

F. Each country would need to have an approach to the support phase that was responsive to local conditions and capacity. Although there would be clear value in Model 1 in a common support forum, this would likely be of less value with countries undertaking parallel development efforts. Nonetheless, having an easy-to-access, easy-to-use support forum could still be an important function to increase peer-to-peer collaboration.

## Model 3

Model 3 represents a hybrid of the first two models (see Figure 9). It offers some of the benefits and some of the challenges found in the other models. As in Model 1, Ethiopia, Zambia, and Tanzania co-create and apply shared design outputs. In this model, however, Ethiopia would proceed independently on its current time frame for development. Zambia and Tanzania would collaborate in co-development, testing, and QA and sequence their development phase to closely follow that of Ethiopia, whose outputs they would use. OpenLMIS could have either an active role in enabling the design, development, testing, and QA or serve only as a "country commons" for outputs from all three countries.

Figure 9. Model 3 for country collaboration.



| | Ethiopia | Zambia | Tanzania | OpenLMIS |
|---|---|---|---|---|
| **1** | Project Management Country Team, MOH, Partners, USAID | Project Management Country Team, MOH, Partners, USAID | Project Management Country Team, MOH, Partners, USAID | Multi-Country Collaboration Enablement and Repository |
| **2** | Design | Design | Design | SDLC Library |
| **3** | Develop | Develop | Develop | SDLC Library |
| **4** | Test | Test | Test | SDLC Library |
| **5** | Deploy | Deploy | Deploy | SDLC Library |
| **6** | Support | Support | Support | Support Forums |

Under Model 3, countries could collaborate and share as outlined below:

A.  Collaboration at the project management level has already begun. This would continue with a deep level of collaboration for Zambia and Tanzania as they proceed to co-develop and test. In this model, the methodology and approach to managing the LMIS project would be agreed to and applied to create a common work plan. OpenLMIS would enhance collaboration by providing a "country commons" for the storage and management of common project management tools as well as potentially the shared project management plan. Further, OpenLMIS could serve as a "country commons" for all three countries by having a single shared repository where templates, guidelines, and SDLC outputs could be stored for easy access for any country. With continued strong collaboration among all three countries, the potential for converging into Model 1 will be carefully assessed. This will be especially true from December 2011 through February 2012. This is the case because the time frame for development in the Zambia 2012 Road Map could accommodate delaying initiation of final design and development until this time and still allow for deployment to be completed on schedule in 2012.

B.  Design collaboration would include all required parts of the SDLC standard documents. In this model, Zambia and Tanzania would collaborate by sharing a common template and continue to co-create all outputs needed for the SDLC design phase. This work may be augmented by an external vendor that may be contracted by one or more of the countries. In any case, all work products would be shared and used for the development phase.

C. Development would be focused on a single core software platform that would be clearly described in the SDLC design phase with each country collaborating. Ideally, the core platform for Zambia and Tanzania would be the Ethiopia Health Commodity Tracking System platform that is to be ported into native C# and Microsoft SQL Server. This phase would require the same degree of collaboration for Zambia and Tanzania that is necessary under Model 1 for all three countries. If this approach is used, there needs to be complete alignment to the development methodology and selection of an external vendor for development.

D. The testing and QA phase would be the same as in Model 1 for Zambia and Tanzania. There might also be value to Ethiopia to be part of a single testing QA team that would include global LMIS software engineers in combination with country resources. Each country would need to engage directly in this activity to ensure that its requirements are met to the level of quality and performance needed throughout development.

E. Deployment activities would remain country specific becuase they must respond to conditions on the ground as well as local capacity. As in Model 1, Zambia and Tanzania would benefit from the same training curricula and methodologies and perhaps might conduct joint train-the-trainer sessions. Understanding and capturing the experience and lessons learned by the first countries deploying the core LMIS platform would be the role of OpenLMIS so that all countries to follow would benefit.

F. Each country would also need to have an approach to support that was responsive to local conditions and capacity. However, having an easy-to-access, easy-to-use support forum would be an important function that could be provided for any country through OpenLMIS. This would enable countries to quickly learn about problems before they occur in their own country as well as to access solutions and guidance from their peers that have already resolved problems. In addition, by having a common support forum, developers can be made aware of country experience and problems not only to provide rapid response to software bugs but also to guide the development of minor enhancements as well as future major product releases.

## A Call to Action

This project has validated that a user-driven approach to the design of a health information system is effective in aligning stakeholders and determining and documenting user requirements. The methodology and common requirements produced at the global level proved valuable to individual countries. This resulted in Zambia and Tanzania saving time and producing a high-quality output  and plan to source a solution supported by stakeholders. The solution described by these countries is virtually the same. Along with Ethiopia, these countries have called for continued collaboration to produce a shared solution to save time and money and to increase the likelihood of success. OpenLMIS presents an important vehicle for this collaboration and deserves to be supported by global stakeholders and donors to deliver the impact and value countries are seeking. Having a strong collaborating role for OpenLMIS means that countries

do not have to bear additional cost or risk that will affect their ability to meet their work plan milestones as a result of collaboration.

Properly funded and supported by global stakeholders and technical partners, OpenLMIS can help mitigate the risk of additional costs of collaboration to each of three *first-mover* country collaborators. In fact, the intention of OpenLMIS is that each country receives much more in value and impact than any additional cost as a result of collaborating with each other and with OpenLMIS. Success will be immediately discernible because Zambia, Tanzania, and Ethiopia need to deploy an LMIS solution in 2012. They have clarity on their requirements, alignment of country stakeholders, and resources in place for implementation. By forming and leveraging a collaborative community through OpenLMIS today, Zambia, Tanzania, and Ethiopia will leverage their collective expertise and resources; future countries seeking to strengthen their LMIS will benefit as well. Countries realize the value in "going together" as a forward preferable to "going alone." The global community can now provide the support needed for these early movers and the global community to realize the value of collaboration.