The Framework for OpenLMIS

White Paper

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THE ROCKEFELLER FOUNDATION

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Executive Summary

There is a growing trend within low- and lower-middle-income countries (LMICs) and the development community working in those countries away from standalone information system projects toward comprehensive, enterprise-level health information systems (HIS). OpenLMIS has been formed to accelerate and support that trend for the supply chain and logistics domain by establishing a community-run, shared repository of freely-available resources for electronic logistics management information systems (eLMIS). Through a collective and collaborative approach, OpenLMIS seeks to build an online, always expanding collection of such resources which are available to anyone designing, building, managing and supporting eLMIS solutions. It is expected that this common and publicly available knowledge and software code base will contribute to the development of eLMIS standards and lead to greater interoperability among eLMIS solutions and beyond to other HIS domains.

Introduction

VillageReach works to increase access to quality healthcare for remote, underserved communities. To address this challenge, VillageReach has focused on improving the performance of the final segment or "last mile" of medical commodities supply chains in low-income countries. Anyone involved with supply chains will agree that performance improvements are not possible without an information system, whether paper-based or electronic, that can illuminate, on a regular and routine basis, how well the supply chain is functioning and identify problem areas in need of attention. VillageReach developed a computerized information system to manage the distribution of medical commodities within the Mozambique public health system from the provincial or intermediate level to the service delivery level. Working just with the Ministry of Health provincial authorities, VillageReach was able to develop an effective solution in a short amount of time at a minimum of cost and effort for the immediate problem at hand: distribution of certain medical commodities to the service delivery level. Because the last mile of product distribution is the first mile of data, the system is rich in key data, such as, inventory levels, stock outs and consumption. But because the system was built without any attempt to collaborate with other stakeholders vertically up the supply chain (e.g., central medical stores, forecasting) or horizontally in other domains (e.g., medical records, dispensing), its value and relevancy to others and therefore its potential for sustainability are severely limited. In effect, VillageReach built an *island of data*.

This scenario is not uncommon. In fact, it is being replayed over and over again across the HIS for public health programs in LMICs. Having multiple actors solving information system problems in near isolation does allow each to work independently with a minimum of resources allocated to coordination and sharing with others. This approach will solve a number of disparate problems quickly, but does nothing to provide the comprehensive, integrated solutions needed to address the more complicated, interrelated challenges facing health information systems in LMICs – and lead to dramatically improved health of the targeted communities. Collectively, we in the global health community have built *many islands of data*. Along the lines of the well-known African proverb - by going alone we may have been able to go fast, but given the absence of a much greater level of collaboration and sharing of solutions, we have not been able to go very far.

Recognizing this situation, a number of thought leaders have come together over the past six years to outline a framework for the development of comprehensive and integrated HIS comprised of ten domains, including supply chain and logistics. In *The Case for Developing and Deploying an Open Source Electronic Logistics Management Information System*, PATH explains the progression of events that has shaped a new way forward.[1] Influenced by these efforts, VillageReach, John Snow, Inc. (JSI) and PATH with funding from The Rockefeller Foundation and the United States Agency for International Development (USAID) formed OpenLMIS[2] to help countries strengthen their supply chain and logistics systems by providing a global commons of shared knowledge, tools and solutions regarding LMIS. The paper referenced above provides the broader context for the formation of OpenLMIS - a shared repository covering supply chain and logistics. It explains *why* OpenLMIS should exist. By answering the following commonly raised questions regarding OpenLMIS, the purpose of this white paper is to propose a framework for *what* OpenLMIS should do and *how* it will work:

- What is the vision for OpenLMIS?
- How will the community benefit from OpenLMIS?
- How is the OpenLMIS community organized?

The Current LMIS Environment

A reliable logistics management information system (LMIS – includes both paper-based and electronic systems) is integral to a well-functioning health system, especially in resource-limited settings. Whether paper-based or electronic, an LMIS serves a variety of functions such as, managing data on the quantity of medicines or supplies needed at specific service delivery point, reporting on current stock levels of supplies at service delivery points, and/or storing and tracking data regarding usage of medical commodities over time at all levels of the health system. Depending on the country, sector (e.g., public, private, NGO), focus of the health program, and level of the health facility, LMIS functionality varies from a small number of reports on a limited number of medical items to complex reports that address nationwide issues on hundreds if not thousands of products.

Historically medical logistics was not recognized as a distinct role among health system staff in LMICs. The associated tasks were done by the staff person who had the time or was responsible for the report, even if he or she had no training in logistics. Thus the doctor, nurse, pharmacist or warehouse manager set up a system that worked for them – and a huge diversity and fragmentation of systems resulted. In the past two decades, due in part to a new focus on supply chain capacity building and donor reporting requirements, the differences in information tracked and system functionality have decreased. Significant variations among systems, however, can still be seen between sectors, programs and levels of the health system.

[1] PATH. *The Case for Developing and Deploying an Open Source Electronic Logistics Management Information System*. Seattle: PATH; 2011.
[2] See, www.OpenLMIS.org.

Managing the supply chain for a small group of health facilities and a small collection of medical commodities can be done with a paper-based system. But once the task is expanded to manage the flow of orders, distribution and planning for all medical commodities across thousands of health facilities along with the system of multi-tier warehouses needed to supply those facilities, the capacity of any paper-based LMIS, no matter how well designed and implemented, is quickly overwhelmed. Given the scope and complexity of public health systems in LMICs, it is clear that comprehensive, integrated, enterprise-level eLMIS solutions are needed.

Building and deploying this type of LMIS solution, however, faces a number of challenges, including:

Defining an LMIS. A logistics management information system means different things to different organizations for many reasons:

- Programs start with one project for which they build an LMIS before shifting or expanding to additional focus areas (e.g., reproductive health programs expanding to include HIV commodities);
- Rather than establish an additional information collection system, the existing LMIS is expanded to include functionality beyond the traditional scope of an LMIS; and
- Additional, situation-specific LMIS functionality is developed in a project because the "official" system does not meet reporting needs.

LMIS definitions vary with respect to: functionality; level of the health system; existence of other information systems; number, variety and type of commodities being tracked; level of analysis and reporting required; and mechanism used for data collection (i.e., paper, computer, mobile device).[3]

[3] To help standardize the definition, the OpenLMIS Functionality Working Group has defined logistics management information systems as follows:

> A logistics management information system (LMIS) is a system of *records and reports* – whether paper-based or electronic – used to aggregate, analyze, *validate* and display data (from all levels of the logistics system) that can be used to *make logistics decisions* and manage the supply chain. LMIS *data elements* include stock on hand, losses and adjustments, consumption, demand, issues, shipment status, and information about the *cost of commodities* managed in the system.
>
> The italicized terms above are further explained below:
>
> *Records and reports*: "Records and reports" are built on the country's existing LMIS system. "Records" can include items such as stock cards or bills of lading which rest at the facility; "reports" include stock expiry reports or reports and requisitions (R&R's). These typically flow between various levels of the logistics system.
>
> *Validate*: Validating data includes: checking that values are within expected range (e.g., no negative numbers or expiry dates before the current date), requiring double entry and confirmation of certain data, or verifying that order quantities are within a reasonable and expected value range.
>
> *Make logistics decisions*: "Logistics decisions" includes stock allocation across multiple facilities or the algorithm to use for forecasting required quantities of supplies. Logistics decisions are based on national standard operating procedures for logistics management.
>
> *Data elements*: "Data elements" include not only the data, but the processes that allow the data to flow up the supply chain to those making program decisions and back down to those implementing in the field. Different data is used and thus available at different levels of the supply chain.
>
> *Cost of commodities*: "Cost of commodities" includes the price of each individual product managed in the supply chain as well as associated shipment costs. These costs are vital for forecasting and supply planning which help in informing the funding required and promoting commodity security.

Collection of partial systems that don't provide interoperability. Expanding on the earlier point that some eLMIS were built by projects in isolation to manage their particular data needs, the resulting eLMIS solutions often have well-delineated functionality that only works in specific settings. Furthermore, these focused interventions were not developed with an eye toward data sharing or interoperability.

No central repository of existing eLMIS solutions. There is no central reference repository of eLMIS solutions; even large international NGOs do not typically have an inventory of all their eLMIS solutions. Each time a gap is identified there is a strong possibility that someone will *reinvent the wheel* by developing a solution that already exists elsewhere. This duplication of effort is not only a waste of resources, but will likely create data harmonization issues later, since different data is collected in different ways for different projects.

Different data on different forms collected by different programs. There are a growing number of programs backed by different sectors, NGOs and donors, each with their own supply chain data requirements. If two or more programs run in the same health facility, multiple data collection forms must often be completed. In the absence of forms standards, NGOs and donor programs generally have their own forms, which duplicate some of the information on the public sector forms, causing staff to record the same data multiple times. When collected by hand, this situation increases the risk of data errors. Since the supply chain data is collected in different formats, it cannot always be shared between programs.

Challenges in forms distribution/management. Health staff are often willing to collect the required data, but do not always receive copies of the current forms. Distributing and managing forms is an integral component of an eLMIS, especially for large systems with a large number of locations processing the forms. eLMIS fragmentation makes this task difficult, if not impossible.

Limited technical support and recurrent budget to expand code base. There is limited technical support for computer hardware and eLMIS applications in low-resource environments. Routine maintenance of computers is often infrequent and program budgets seldom include the cost of machine repair/replacement or software upgrades. New reports (to the government or donor) can require adapting software, but the skills/expertise and funds to make those changes may not be readily available.

Solutions built in isolation are hard to generalize across other programs. When a single program designs a computer application or database to track project data, the application tends to be tailored to the use cases and requirements of that one specific project. The resources are often not available to build out a generalized solution for a specific, localized problem. Consequently, such solutions are not built for adaptability, are not well documented, were not developed with total cost of ownership in mind, and are hard to maintain once the original authors move on.

Balancing redundancy against duplication. When both paper and digital systems exist, there is a balance that must be found between having a robust system to capture data and duplicating data collection efforts. This balance changes as the program grows: as staff become more skilled with the digital system and the eLMIS become more robust, less redundancy is required. Procedures

must be put in place for data collection when the digital system is offline. In some circumstances, it is possible to collect data asynchronously, but the system must be robust.

Fortunately the past decade has seen a number of new trends which present new opportunities for building and deploying comprehensive, enterprise-level eLMIS solutions:

Availability of computerized systems in LMICs. Affordable computers with adequate battery life to work in places with intermittent power supplies are increasingly available. Computers are being supplied at the central, regional and district levels and health system staff are being trained to use them. A variety of programs – spreadsheets or databases – have been developed to improve management of pharmaceutical and medical commodities by tracking stock levels, supplying information needed for monthly and quarterly reports, calculating average usage patterns and feeding the data into re-order requests.

Emphasis on horizontal health system strengthening. Over the past decade the pendulum in global health has been swinging toward a greater emphasis on horizontal health system strengthening and away from vertical disease-focused programs. This shift is likely to reduce eLMIS fragmentation.

Expanding internet/mobile networks. Infrastructure in support of internet and mobile networks continues to expand in LMICs. This expansion has engendered an explosion of new pilot projects showcasing the use of new information communications technologies for health. With this new wealth of experience, many are looking to transition pilot projects into comprehensive, sustainable solutions.

Focus on sustainable, scalable projects. While pilot projects are able to showcase the application of new technologies, the goal has always been to sustain and scale the promise of these projects. Increasingly, donors are asking each new effort to justify itself with respect to sustainability and scalability.

Interest in interoperable solutions. With the move toward enterprise-level systems, interoperability among HIS solutions is necessary not only to weave the various domains into an integrated system, but to leverage the value of each individual solution across an entire HIS.

Greater availability of open source solutions. Information communications technology managers in LMICs have repeatedly asked for open source alternatives to custom-built solutions and commercial off-the-shelf software. Open source initiatives such as OpenMRS for patient records and the District Health Information System 2 (DHIS2) for health statistics have led the way. Both initiatives have built strong communities of contributors, enhanced local capacity in LMICs, and are enabling and supporting implementations in a rapidly growing list of LMICs. These growing communities are reducing the total cost of ownership for those systems through peer-to-peer support groups and sharing the burden of code base development, maintenance and enhancement. Given their significant success, the demand for open source alternatives, including for supply chain and logistics solutions, is increasing.

A Shared Vision

Against this backdrop, a number of organizations[4] working with eLMIS in LMICs have come together with a vision for a new approach. OpenLMIS is 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 the place for sharing information about eLMIS planning, requirements and system design, promoting interoperability between systems, developing open source solutions where appropriate and galvanizing interest in a shared vision for effective, scalable and sustainable eLMIS solutions.

Specific objectives of the OpenLMIS initiative are to:

- Provide a repository of tools, product and project assessments, best practices, requirements, use cases, reference implementations and other information to promote a collaborative approach for eLMIS solutions;
- Collect and share reusable, proven building blocks for eLMIS solutions that can be adapted by individual countries for country-specific eLMIS implementations;
- Encourage the use of international standards in supply chain and health informatics;
- Encourage seamless interoperability and flow of information between supply chain layers and other HIS domains;
- Provide a demonstration/test environment to assist in the creation of open source eLMIS applications; and
- Improve critical decision-making in order to address the dynamic health service requirements of LMICs.

It is also important to dispel a few common misperceptions of OpenLMIS. Accordingly, OpenLMIS is *not* intended to:

- Supplant the logistics processes, policies or decision making authority of governmental authorities charged with the responsibility for their country's health supply chains and associated LMIS;
- Create a country-specific or off-the-shelf eLMIS software product;
- Lock any country or anyone else into a particular eLMIS approach or methodology;
- Reduce competition amongst advisors, software vendors and others to build the most effective and cost-efficient eLMIS solutions; or
- Displace commercial off-the-shelf products.

Perhaps the best way to conceptualize this shared vision is through a simple analogy. Imagine a neighborhood of families, each with a collection of books. Some households have many books; others have only a few. Some families are even authoring new books for their own use on a regular basis. Each household's access to books is limited by the extent of their own collection. Because the book collections are separate and no family has access to the collections held by other households;

[4] Current organizations participating in OpenLMIS include: Crown Agents, I-TECH, John Snow, Inc., Management Sciences for Health, mHealth Alliance, Open Health Tools, Partners In Health, PATH, Rockefeller Foundation, the Partnership for Supply Chain Management, USAID and VillageReach

the families do not share a common knowledge base. Alternatively, two or more families could voluntarily contribute all or some portion of their book collections into a community library. There, the books are held in a shared repository of resources or common good. Each family now has access to a common knowledge base which exceeds their individual book collections. The families participating in the shared resource can even coordinate which new books need to be written to enhance the collection. The community library model, however, immediately raises a number of questions:

- What resources does the library make available to the community?
- How are the resources organized within the library for easy access?
- How is the creation of new resources coordinated?
- Who has access to the library?
- What are the rules for the use of library resources?
- What motivates the families to share private resources?
- How is the community library managed and maintained?
- Who determines which book contributions are accepted versus those that are rejected?

Because a shared repository is central to the shared vision of OpenLMIS, similar questions have been raised regarding OpenLMIS. In answer those questions, the following sections provide a proposal for structuring and organizing OpenLMIS.

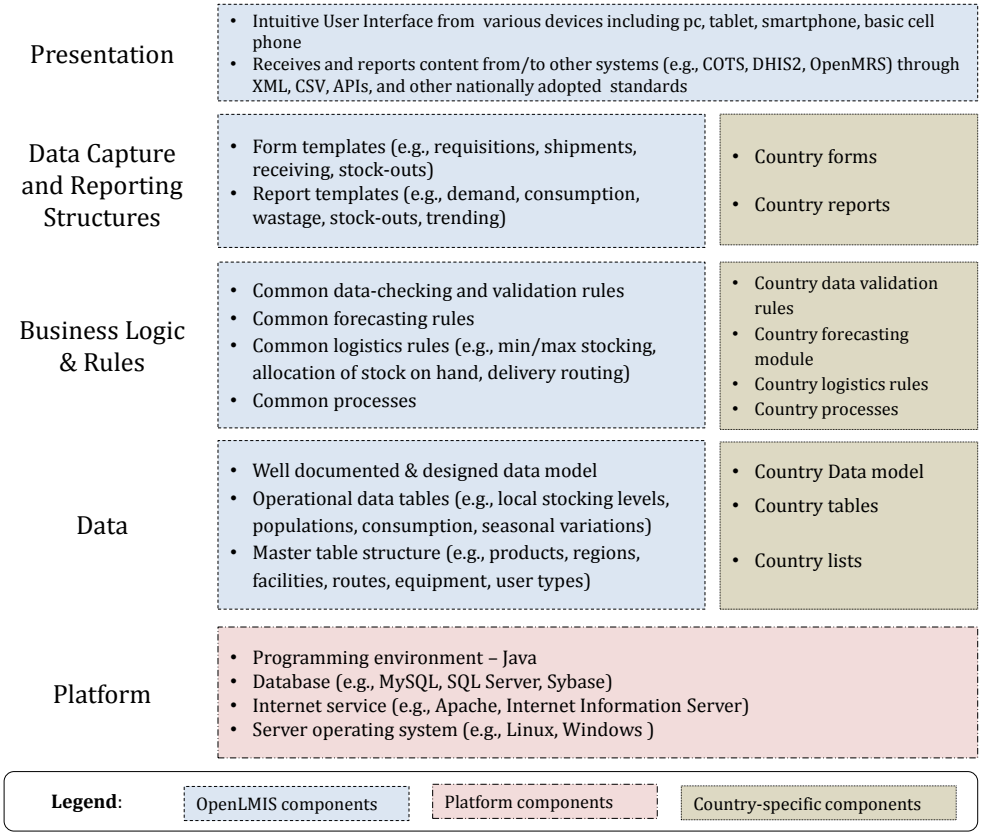
The Shared Repository

As noted above, one major challenge LMICs face is the lack of resources, tools, and common, reusable building blocks available to plan and create their own country-specific eLMIS enterprise architectures and solutions. OpenLMIS seeks to provide an environment with valuable information and tools that can be shared with countries, donors, technical agencies and software developers that are preparing requests for proposals, evaluating alternative solutions, conducting landscape analyses, and developing eLMIS solutions. For example, the OpenLMIS shared repository offers the Common Requirements for Logistics Management Information Systems as a resource.[5] It documents how to apply the collaborative requirements development methodology (CRDM) to determine and document user requirements, and develop global common, reusable requirements for eLMIS solutions in LMICs. With common eLMIS requirements, developers, custom software developers and commercial off-the-shelf (COTS) suppliers have a starting point to support country or project-specific requirements and technical specifications which must be adapted and documented within the context of a specific eLMIS project. Creating a common framework for understanding each supply chain function is a critical first step, not only for creating comprehensive eLMIS solutions, but for creating eLMIS solutions that can be integrated with and leveraged by other HIS domains.

OpenLMIS is also intended to provide access to open source eLMIS software solutions for in-country supply chains. Given the complexity of in-country supply chains and an existing installed

[5] See http://OpenLMIS.org/shared-approach/introduction-to-crdm/.

base of numerous software applications, the emphasis will be placed on building a common system architecture and reusable functional modules that will enable countries to be more efficient in creating their specific implementations. In the diagram below, items identified as "OpenLMIS components" represent areas of focus for OpenLMIS software development. It is hoped that items identified as "Country-specific components" will also be contributed to the shared repository by countries that have implemented their eLMIS solution to serve as reference models for other countries.



A number of resources have already been contributed to the shared repository, all of which are available at *www.OpenLMIS.org*. The shared repository, however, is only in the initial stages of being built and will take time to accumulate the array of resources needed by target user groups to build comprehensive, enterprise-level eLMIS solutions. To help visualize what the shared repository should become and a recommended path along which resources are accumulated, an initial index of existing and potential resources is attached as Appendix A – Index of the Shared Repository. The index, among other things, lists each resource, provides a description, describes the type of resource (e.g., guideline, template, example, source code), and identifies the licensing model under which the contributor of a particular resource has made it available.[6] The index indicates whether the resource is available or, if it is not already available, a suggested prioritization for getting the resource into the repository. Each resource is also referenced, when appropriate, to the Software Development Life Cycle (SDLC) and the Common Requirements for

[6] See *Community Organization* below for a description of the licensing models applicable to the OpenLMIS shared repository.

Logistics Management Information Systems. The index is dynamic and will evolve over time based on input from the community and the particular resources which are contributed. The most up-to-date version of the index can be found at *www.OpenLMIS.org*.

In the near future we expect to transition the shared repository to an automated, online tool with full-featured search tools.[7] The shared repository will be indexed in the major search engines (e.g., Google, Bing) and will provide targeted search and sort capability within the repository. The shared repository will handle version control and provide the ability to look at prior versions of any resource for historical purposes. Community forums will be available for support, the exchange of information, and the development of new ideas. The success of OpenLMIS will depend on the accessibility and value of the shared repository and the community built around it for those engaged in the planning, development, deployment and/or support of country-specific eLMIS enterprise architectures and solutions.

Community Organization

The organizational model for most open source communities is radically different from the manner in which governmental, non-governmental and commercial entities are normally structured. The latter typically have top-down command structures where strategy is set at the top, then managers and workers are organized into groups to implement the strategy that has been set. Most of the eLMIS applications currently deployed in LMICs has been developed through these types of organizations. Open source communities, on the other hand, usually grow from the bottom up through a voluntary, grassroots process.

The community library example outlined above is instructive. Most open source communities start because two or more people share a set of common problems, are willing to solve those problems individually and/or collectively, and then share the resulting solutions with others. While participants in open source communities likely do not share all of their solutions (even if the problems they have solved are not unique to them), they are motived to share a portion of their solutions. The motivation voluntarily to share some portion of the fruits of one's labor is usually based on the fact that by combining resources, community participants expand their limited resources, gain access to a broader talent pool, benefit from the development of standard practices, and establish a foundation for enhanced results. The downside to this model includes increased investment of resources needed for collaboration, competitive advantage lost with respect to the resources that are shared, and freeriding (i.e., by participants who take but don't contribute). Obviously, successful open source communities exist because, at least for each of those communities, the benefits for each participant outweigh the cost of their participation.

To be useful on an ongoing basis, a shared repository must have one or more participants who help guide the process of organizing, building and maintaining the resources. Prospective participants, however, are not obligated to contribute resources or use them. In other words, leadership is

[7] For good examples of online, fully-automated shared repositories, see *http://www.eclipse.org/resources/* and *https://www.projects.openhealthtools.org/sf/sfmain/do/listProjects*. Open Health Tools is establishing a shared repository platform to support OpenMRS, OpenLMIS and other HIS open source communities. It is expected the OpenLMIS shared repository will migrate to that new platform when it becomes available.

required, but following is not mandatory. Accordingly, any leadership that is provided must closely align with the interests of other participants; otherwise a leader will head in a particular direction and no one will follow. A related principle of this type of consensual, grassroots organization is that the shape of the initiative is determined primarily by those who are willing to make the effort to advance it forward. As OpenLMIS participants coalesce into a community with common interests, the direction OpenLMIS takes will evolve and become clearer over time.

Admittedly, the organizational principles relating to why participants contribute their resources and how OpenLMIS develops are loose. This approach is common for open source initiatives especially in the early days of their development. The organizational principles defining the rights of contributors and the rights of users to use the resources made available by the shared repository, however, are clearly articulated. The resources placed in the shared repository by contributors include articles, guidelines, templates, reference models and software code. Each of these resources represents intellectual property made available by its contributor. In each case, ownership of a resource remains with its contributor. By making the contribution, however, each contributor agrees to make its resource available to others under the terms of one of the license agreements identified by OpenLMIS.

OpenLMIS has adopted internationally recognized and approved open source license agreements to define how the resources may be used. The license agreements perform an important organizing function for OpenLMIS by empowering users through access to intellectual property, granting most rights to users vs. reserving them for the authors, and preventing users from restricting the use by others. The two licenses adopted by OpenLMIS are the Eclipse Public License 1.0 (EPL) and the Creative Commons Attribution 3.0 Unported License (CC).[8] The EPL applies to source and object code and related documentation in the shared repository. In general, the EPL provides the following rights and obligations:

- A broad, royalty-free license to use, modify and distribute;
- Modifications must be contributed back to the shared resource;
- Users may incorporate the resource into commercial products;
- No warranties or liabilities are provided; and
- Each resource, in original or modified form, must retain attribution to the original author.

The CC provides similar rights and obligations for documentation. It is likely that contributors may wish to add other resources into the shared repository with a more limited approach based on copyright rules. The OpenLMIS website will provide terms of use (ToU) to define usages rights for such content. The shared repository may also contain resources that have been placed in the public domain for which the original author has renounced all intellectual property rights. Public domain resources may be used without restriction.

With support from the Rockefeller Foundation, VillageReach has committed to facilitate the development of OpenLMIS through May 2013. That commitment includes:

[8] See http://www.eclipse.org/legal/epl-v10.html and http://creativecommons.org/licenses/by/3.0/.

- Establishing and maintaining the OpenLMIS website, online facility to house shared repository, and related project workspaces and forums;
- Contributing various resources to the shared repository to jumpstart the aggregation of resources that are valuable to target users and the OpenLMIS community;
- Organize various meetings and for the OpenLMIS community task forces; and
- Publicly promoting OpenLMIS and the positive impact it can have on the development of eLMIS standards and solutions and, ultimately, the improved health of underserved populations in LMICs.

VillageReach's proposed organizational principles for OpenLMIS are attached as Appendix B. The principles are suggested for first year or so of OpenLMIS and are expected to evolve based on input from the OpenLMIS community.

Moving Forward

This white paper has provided a framework under which OpenLMIS can build a community and make an increasing array of valuable resources available for that community. Although OpenLMIS is meant to augment rather than replace existing approaches to eLMIS development, this framework reflects a new approach to supporting the development of eLMIS in LMICs. OpenLMIS' success will depend on the value the shared repository can deliver for countries, donors, technical agencies and software developers engaged in LMIS development. Aggregation of useful and relevant eLMIS resources into a freely-available, shared repository will depend on a community coalescing around a desire to go far, and the understanding that to do so, we must go together.

Appendix A – Index of the Shared Repository

Resource	Description	Contributor	Format	Language	Availability	SDLC sequence reference	License model	CR section
Common Requirements for Logistics Management Information Systems	A set of common requirements for public health logistics management information systems, developed by a diverse group of logistics professionals from around the world and tested in Kenya, Rwanda, Senegal, and Vietnam.	PATH	Publication	Eng	Sep-10	0 - Initiation	CC	
The Case for Developing and Deploying an Open Source Electronic Logistics Management Information System	A white paper describing the process of developing and testing common requirements for logistics management information systems using the Collaborative Requirements Development Methodology (CRDM) and making the case for creating global common and shareable solutions to support country-driven design and implementation.	PATH	Publication	Eng	Jan-12	0 - Initiation	CC	
The Framework for OpenLMIS	A white paper describing OpenLMIS goals, value and organizational principles	VillageReach	Publication	Eng	Feb-12	0 - Initiation	CC	
Developing a Computerized LMIS: A Guide for Program Managers	A guide for Program Managers leading efforts to computerize LMIS in low to middle income countries. (To be published in 2012)	USAID | DELIVER Project	Publication		Jul-12	0 - Initiation	CC	
LMIS Requirements for country A	LMIS country specific requirements for country A		Publication			0 - Initiation	C/ToU	
LMIS Requirements for country B	LMIS country specific requirements for country B		Publication			0 - Initiation	C/ToU	
LMIS Business Process Best Practices	Analysis of the best practices associated with successful LMIS implementations including clinical, legal, financial, administrative		Guidelines			0 - Initiation	C/ToU	
Landscape Analysis of Existing eLMIS Solutions	An inventory of existing eLMIS solutions, the countries in which they are implemented, and their functionality (to be published by USAID | DELIVER Project in 2010)	USAID | DELIVER Project	Publication	Eng	Jun-12	1 - Acquisition	CC	
LMIS RFP example	SDLC LMIS RFP template with sample data		Template			1 - Acquisition	CC	
OpenLMIS Reference Model Functional Overview	Description of OpenLMIS reference model components and how they map to common requirements for LMIS	VillageReach	Publication			2 - Planning	CC	
TCO Budget Example	Total Cost of Ownership Budget Worksheet template with sample data		Template			2 - Planning	CC	

Electronic LMIS Roles and Responsibilities	Sample analysis of the skills and functions of all human resources involved in successful electronic LMIS solutions, including capacities/skills needed at each level that the system will be implemented.		Guidelines			2 - Planning	CC	
Example of Data Flow for eLMIS	Descriptions of the multiple supply chain data flow processes captured in the OpenLMIS reference model. Each program will have different definitions establishing what information is available at each level of the supply chain and how it moves between levels but this resource can be used as a starting place for defining data flow for any in-country customization or implementation.		Guidelines			3 - Requirements Analysis	CC	0
Sample Data Access Levels & Permissions	Description of staff access permissions to relevant supply chain data in the eLMIS. Different staff/positions at different levels need access to different supply chain data. Generic types of staff positions can be categorized and data access granted by position, or data access can be customized for each individual user account is created. This document will outline the generic roles available in the reference model based on common use cases.		Guidelines			3 - Requirements Analysis	CC	0
Specifications for LMIS Reports	Catalog of generic eLMIS reports specifications that can be used as templates for developers and also in the reference model. Reports specifications will be accompanied by documentation that explains the data in the report, the algorithms behind the report, and the user roles that are likely to use and generate and the report. Likely reports include order status reports, consumption reports, current stock level reports with overstock/understock notification, pending expiries, receiving or delivery reports, product reports by funding source, projected need reports, etc.		Guidelines			3 - Requirements Analysis	CC	1 - 6

Examples of Algorithms to Allocate or Ration Stock in LMIS	Catalog of algorithms that can be used allocate or ration stock in eLMIS. Stock is allocated to the requesting facility using different strategies (first come, first served; hospital before health center; priority to antenatal programs, etc.), based on the therapeutic category of the commodity (ART, gauze), or lead time to procure additional supplies (local vs. international procurement), among others. When there is insufficient stock, rationing comes into effect. The examples listed in this publication will be generic examples used in the reference model based on common use cases.		Guidelines			3 - Requirements Analysis	CC	1.4
LMIS System requirements plan (SRS) example	SDLC LMIS System requirements plan (SRS) template with sample data		Template			3 - Requirements Analysis	CC	
eLMIS Use Cases	A set of generic use cases to describe core eLMIS functions and interactions		Guidelines					
OpenLMIS Relational Data Model (RDM)	Description of OpenLMIS data model for reference model. This is the Master Data Model and includes sub-elements such as Facility Item master and Medical Item master that are identified as separate components	VillageReach	Publication		Jan-12	4 - Design	EPL	
OpenLMIS Systems Architecture	Description of OpenLMIS software architecture for reference model.	VillageReach	Publication		Jan-12	4 - Design	CC	
OpenLMIS RDM Medical Item Master	Description of OpenLMIS Medical item master for reference model. Template with a master table of commodity characteristics. Each implementation can select which attributes they choose to implement or add their own characteristics. Certain attributes would be strongly recommended for all implementations as a standard. Additional columns that would be helpful to include would be cost per unit as defined by the MOH or Medical Stores, as well as "Funding Sources" in case reports need to be run on specific commodities supplied by specific funders. Should include a way link equivalent products that can be used as substitutes if one item is out of stock.		Publication			4 - Design	EPL	0

OpenLMIS RDM Facility Item Master	Description of OpenLMIS Facility item master for reference model. Template with a master table of location characteristics that will be built into the data model to allow for a variety of different options for health system structure. Can be used by in-country implementations to define commodities managed at each level, as well as access permissions to the LMIS. Examples: Hospital, health center, dispensary, central warehouse, zonal warehouse, CBD site.		Publication			4 - Design	EPL	0
Example of Backorder Process in LMIS	Description of backorder processes commonly used in LMIS. Depends on a procedure being in place to define what it means to request the same item again from country SOPs, and also needs to consider how the requested amount is included in the demand forecasting calculations. Also, once an item is placed on backorder, there needs a define of how long a request stays on backorder.		Guidelines			4 - Design	CC	2.3
Catalog/examples of reporting shipment discrepancies, damage, batch mismatch and shipment rejection in eLMIS	Examples of methods of reporting shipment discrepancies, damage, batch mismatch, shipment rejection and returns. If a shipment does not match the packing list, various types of users need to be informed of the mismatches. Some information must be shared with multiple levels of the supply chain (e.g., if an SDP receives an alternate batch number of a medicine, that information should be shared with anyone responsible for batch recall). If an SDP identified a defective product, some systems might choose to notify all users of that product or all sites that received that batch.		Guidelines			4 - Design	CC	2.3
Order Processing Examples	Examples of ways to process orders including who submits, who has to approve/validate, who has the ability to change orders, what happens if there are not adequate funds, etc.		Guidelines			4 - Design	CC	4.1
Sample SOPs	Sample SOP templates and/or examples (if available) for LMIS.		Publication			4 - Design	CC	4.8, 4.6
Interoperability Considerations	Considerations for linking eLMIS to other health information systems such as Warehouse Management Systems, medical records systems, procurement systems, health management information systems, etc. This publication would talk about requirements and considerations for linking the LMIS to these other systems.		Guidelines			4 - Design	CC	6
Example Process for Emergency Requisitions for LMIS	Example process for emergency requisitions. Describe the difference between emergency ordering and how that can be handled in the eLMIS as opposed to routine ordering on a pre-defined schedule.		Guidelines			4 - Design	CC	0

Examples of LMIS Screens from Model Systems	Catalog of eLMIS screen and data capture from various sources indexed in the OpenLMIS repository. Can be used as a prototype to give to developers during design phase to demonstrate user interface and functionality requirements.		Template			4 - Design	CC	
OpenLMIS Demo & Test Environment	Description and operating guide of the OpenLMIS hosted demonstration and developer test environment	VillageReach	Publication		Jun-12	6 - Verification	EPL	
SDLC LMIS Training material example	SDLC LMIS Training material template with sample data		Courses			6 - Verification	CC	
vrMIS3 - VillageReach Management Information System.	vrMIS3 is an eLMIS based upon a vendor managed inventory type distribution model. vrMIS3 is currently used in Mozambique to track distribution of vaccines, medicines and equipment supplied to rural health centers. Source code, data-model and documenation.	VillageReach	Source Code	ENG, PRT	Mar-10	N/A	EPL	
Additional eLMIS Source Code	Source code for various open source eLMIS components		Source Code				EPL	
OpenLMIS Concept Proposal	Concept proposal and framework to advance OpenLMIS	VillageReach	Publication		Jan-11	N/A	CC	
OpenLMIS Community Structure, Participants and Schedule	Charter and operation principles for OpenLMIS community	VillageReach	Publication		Feb-12	N/A	CC	
OpenLMIS Open-Source Structure and Process Steps	Details of the OpenLMIS source repository and implementation of the Eclipse and Creative Commons licensing		Publication			N/A	CC	
OpenLMIS Reference Model overview	Presentation highlighting user benefits of OpenLMIS reference model	VillageReach	Presentation			N/A	CC	

Appendix B – Initial OpenLMIS Organizational Principles (Proposed)

The following organizational principles are proposed by VillageReach to guide the initial development of OpenLMIS. It is understood that these principles will and should evolve over time based on the collective desires of an expanding OpenLMIS community.

- There is a growing trend within low- and lower-middle-income countries (LMICs) and the development community working in those countries away from standalone information system projects toward comprehensive, enterprise-level health information systems (HIS). OpenLMIS has been formed to accelerate and support that trend for the supply chain and logistics domain by establishing a community-run, shared repository of freely-available resources for electronic logistics management information systems (eLMIS). Through a collective and collaborative approach, OpenLMIS seeks to build an online, always expanding shared repository of such resources which are available to anyone designing, building, managing and supporting eLMIS solutions. It is expected that this common and publicly available knowledge base will contribute to the development of eLMIS standards and lead to greater interoperability among eLMIS solutions and beyond to other HIS domains.
- The shared repository is operated by the OpenLMIS community to guide the general categories of resources (but not the content of those resources) that may be contributed. The repository includes documents and publications, source/executable code, demo/test environments and newsletters/updates. Only registered users can post new resources and utilize the testing environment. Registration is offered online to anyone without charge. Use of the shared repository is freely available to registered and non-registered users. The ability of users to use the resources is based on open source licenses, both of which are well-known and internationally accepted open source licenses (i.e., Eclipse Public License 1.0 and Creative Commons Attribution 3.0 Unported License). At the present time, these licenses provide the primary organizational structure for OpenLMIS
- Participation in the community is completely voluntary; individuals and groups are expected to engage and disengage as their needs change. Leadership from the community is welcome; following, however, is not mandatory.
- With support from the Rockefeller Foundation, VillageReach has committed to facilitate the development of OpenLMIS through May 2013. That commitment includes:
    - Establishing and maintaining the OpenLMIS website, online facility to house the shared repository, and related demonstration environment, project workspaces and forums;
    - Contributing various resources to the shared repository to jumpstart the aggregation of resources that are valuable to the OpenLMIS community;
    - Organize various meetings for the OpenLMIS community and task forces; and
    - Publicly promote OpenLMIS and the positive impact it can have on the development of eLMIS standards and solutions and, ultimately, the improved health of underserved populations in LMICs.