

COUNTRY GUIDANCE ON SELECTING LMIS

Results of Request for Information
conducted jointly by Gavi and The Global
Fund

Qualified Software Solutions for
Logistics Management Information
Systems (LMIS)

2019

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Introduction

Well-functioning supply chains for medicines, vaccines, contraceptives and other products are key to reaching people in need of improving, maintaining or protecting their health. Managers of supply chains depend on timely and accurate data to make informed and effective decisions about routine operations like forecasting demand and resupplying health facilities. Data also inform strategic decisions to make supply chain design, processes and workforce more efficient and cost-effective.

Introducing or enhancing a digital logistics management information system (LMIS) in a country's health supply chain improves the collection, analysis, communication and use of accurate data for effective decision-making. A digital LMIS tracks the rate of consumption of health products; stock levels throughout the system; risks of stock-outs or expiration dates; temperature excursions for cold chain equipment; asset functionality for cold chain or diagnostic equipment; and operational performance at all levels of the supply chain. An LMIS application should also be interoperable with other national health information systems (HIS) containing vital data streams such as disease caseloads, diagnostic information, population distribution data, health facility data and others.

Purpose

The purpose of this document is to support country planning for new LMIS software selection, acquisition and deployment. It identifies off-the-shelf applications and service providers that meet global standards and common requirements for health supply chain LMIS that are appropriate in challenging and resource-constrained environments. This document also addresses key considerations and preconditions for acquiring and deploying a digital LMIS. It is not intended to be a comprehensive guide to the entire information systems deployment lifecycle.

Background

Investments in off-the-shelf software applications for information systems that are that are robust and replicable in multiple countries and contexts must also show value for money. This approach eliminates the need for costly and time-consuming development, minimizing deployment time frame and start-up costs and reducing the risk of software becoming obsolete. This guidance document identifies reusable and configurable LMIS software solutions and service providers that can help countries evolve from paper reporting and standalone technology (such as Microsoft Excel spreadsheets) to integrated and networked LMIS software applications that simplify data entry and access, and improve data quality, visibility and use.

In November 2018, Gavi, the Vaccine Alliance, and the Global Fund to Fight AIDS, Tuberculosis and Malaria collaborated to issue a joint Request for Information (RFI) for off-the-shelf LMIS software and services that support most supply chain functions and enable end-to-end visibility. The requirements listed in the RFI were based on the Target Software Standards (TSS) for vaccine LMIS¹ developed by

¹ Target Software Standards for Vaccine Supply Chain Information Systems. Gavi, 2018.
<https://www.gavi.org/library/gavi-documents/white-papers/target-software-standards-for-vaccine-supply-chain-information-systems/>

Gavi but generalized to address the needs of all health products. The purpose of the RFI was to identify a group of qualified LMIS software and service providers that Gavi, the Global Fund or other funding, donor or technical assistance agencies can recommend to countries seeking a new LMIS.

The RFI resulted in more than 20 responses, which were submitted in January 2019 and reviewed by a Technical Evaluation Committee (TEC) comprising experts from Gavi, the Global Fund, the Bill & Melinda Gates Foundation, UNDP and USAID. Seven software solutions and service providers were fully or mostly qualified to support visibility from the central/national storage level to the health facility level. They include proven open-source applications as well as commercial products that come with either software licensing or Software as a Service (SaaS) agreements (see Table 1). An additional eight applications were found to offer functionality that may be appropriate in specific contexts, as summarized in Annex 1.

Note: While this guidance is focused on selecting the appropriate information system for a particular country and context, the technology should be complemented. Countries seeking a new LMIS should analyze and plan for supporting complementary efforts to strengthen people's capacity; improve supply chain processes; and align policies and regulations to enable effective use of the LMIS and the data it contains.

Key Considerations

1. Country Readiness

The decision to invest in a digital LMIS application and services begins with an assessment of a country's readiness, taking a hard look at the maturity of existing supply chains and the coverage and reliability of mobile and broadband networks. Having a clear understanding of what the challenges and constraints are, and what they might be in the coming 5-10 years, will help decision makers select the right LMIS -- not only for their current needs and capacity but also for the future state they want to achieve. Selecting and implementing the right LMIS requires careful planning and sufficient resources and consideration of multiple factors. To ensure the success of the LMIS implementation, supply chain actors should consider the readiness of the system with regard to the following areas:

- effective supply chain business processes² or a commitment to the time and resources needed to improve business processes before or during automation;
- a strong multidisciplinary team comprising experts in supply chain operations, information technology, health programs and information system project management;
- long-term political, institutional and financial support;
- committed resources (people, equipment and funding) to complete the project;
- Internet connectivity, coverage and reliability in the country.

2. Total Cost of Ownership

The capital (one-time) investment cost of acquiring an LMIS application is one aspect of understanding the total cost of ownership (TCO), which will include the licensing or service fees and the external services needed for project management, software configuration or customization, support for user testing, data migration and change management. In addition, the TCO should include estimated annual operating costs over three to five years. Operating costs include: ongoing user and system support; hosting services; system administration (including security and backup); upgrades; hardware

² Business processes are a series of linked activities necessary to achieve a goal. In supply chain, these include forecasting and supply planning, requisition/allocation, order processing, transport, receiving, storage, temperature monitoring, etc.

and internet service provision for users; and periodic training for new users. The TCO is essential for sustainability and should be used to mobilize resources for the upfront investments and to budget for ongoing operational costs from the national budget.

3. Interoperability

Digital LMIS should be integrated into broader supply chain and health information systems (HIS) to enable deeper analysis, better workflows and greater visibility across the health system. A digital LMIS should be linked with: master facility registers, which enable all HIS applications to use the same facility code; and HMIS (eg, DHIS2) applications to enable deeper analysis, such as comparing program service data with product consumption or stock availability. Where possible, a digital LMIS should also be linked with: programme e-registries, electronic medical records (EMRs) or hospital management systems to automatically gather dispensing or utilization data; and supplier enterprise resource planning (ERP) software to enable automated ordering and to track the status of order fulfilment. *Interoperability was a requirement of the RFI and is provided by the recommended applications in this guide.*

4. Supply Chain Data Integration

If a country program (eg, HIV, malaria, reproductive health, EPI) is seeking to acquire and implement a digital LMIS to manage its program's commodities, other programs should be engaged in defining the requirements so that a single integrated application can be deployed to manage all health products. This approach enables economies of scale and cost-sharing between programs; is easier to support over the long term; and reduces unnecessary redundancies. An integrated LMIS does *not* require the integration of distribution channels for all health products, as long as the LMIS supports program and product-specific data requirements, workflows, reports and others.

5. Change Management, Support and Continuous Improvement

Change management is a long-term effort that includes a communication and training strategy to inform relevant stakeholders how they (or their work) will benefit, what their roles will be, when they will be trained, how they will be supported and how performance will be monitored. There should be active and committed experts at every level who are engaged in decision-making about the new system and who can be change agents among their peers. There should be user support resources for post-deployment support and mentoring, troubleshooting, bug fixing and others. The change management component is a long-term investment and should be factored into the TCO of any new system by securing sustainable funding. And the LMIS should not remain static; structures should be put in place to enable continuous improvement and evolution of the LMIS based on changing circumstances like new products introduced, new distribution nodes or new facilities.

Essential Requirements

The effective digital LMIS is a secure platform of integrated or interoperable applications that enable automatic supply chain data collection, validation, classification, storage, analysis and visualization (reporting and dashboards). The range of supply chain data collected and processed will be available from multiple sources managed by different actors potentially using varied stock or data management tools at different tiers in the national supply chain network (Figure 1). Data sources may include, among others: one or more central/regional/district level warehouse ERP/warehouse management systems (WMS); electronic point-of-service stock and/or dispensing applications; community level mobile stock management applications; paper-based stock cards; products utilization registers; and routine LMIS reports.

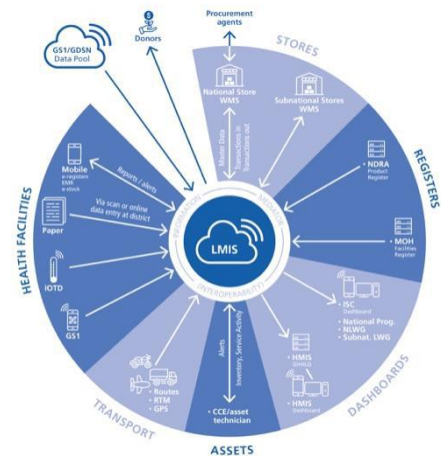


Figure 1: LMIS Conceptual Model (see Annex 2 for larger image)

The seven qualified LMIS software solutions (Table 1) must meet a common set of essential requirements. These include core functional requirements and technical operating requirements (see Annex 3 for the complete list of requirements). Among these requirements, some are important in resource-constrained settings and complex health systems:

- Ability to support workflows while offline; store the data; and upload and sync the data when the local device is connected to the internet.
- Open data standards to enable automatic data exchange with other supply chain management and HIS applications including DHIS2.
- Proven to work with existing deployments in resource-constrained settings.

All of the qualified LMIS solutions meet these requirements.

Qualified LMIS Software Solutions and Service Providers

[Logistimo](#) ([Logistimo India Private Limited](#), info@logistimo.com) is a full-featured LMIS deployed at scale in India, Indonesia, Myanmar, Uganda and Zambia. It interoperates with WMS and ERP solutions used at distribution centres (eg, central or regional/state medical stores). Logistimo is available as a cloud-based SaaS or it can be locally hosted, and it supports multi-user interfaces for web browsers, smartphones and tablets.

[OpenLMIS](#) ([OpenLMIS Trusted Partners](#), info@openlmis.org) is a full-featured LMIS deployed at scale in Côte d'Ivoire, Guinea, Malawi, Mozambique, Tanzania and Zambia. It interoperates with: WMS and ERP solutions used at distribution centres; and electronic medical records systems and e-registers used at health facilities. OpenLMIS is available as a cloud-based or locally hosted solution.

[mSupply](#) ([Sustainable Solutions](#), info@msupply.org.nz) is full-featured WMS with LMIS functionality deployed at scale in more than 30 countries in Africa, Asia and the Pacific Islands. mSupply is available as a cloud-based SaaS or it can be locally hosted, and it supports multi-user interfaces for web browsers, smartphones and tablets.

[Vitalliance LMIS](#) ([Vitalliance Corp](#), info@vitalliancecorp.com) is based on a control tower solution (Real Time Value Network) with ERP, WMS and LMIS functionality and is deployed at scale in Ghana and Rwanda. Vitalliance LMIS is available as a cloud-based SaaS, and it supports multi-user interfaces for web browsers, smartphones and tablets.

[Entution Vesta](#) ([Bileeta Pvt., Ltd.](#), info@bileeta.com) is a full-featured ERP with WMS and LMIS functionality deployed at scale in Nepal. It is available as a cloud-based SaaS with multi-user interfaces for web browsers, smartphones and tablets.

[e-LMIS Medexis](#) ([i+solutions](#), info@iplussolutions.org) is a full-featured LMIS deployed at scale in Burundi. It interoperates with WMS and ERP solutions used in at distribution centres. e-LMIS Medexis is available as a cloud-based SaaS with multi-user interfaces for web browsers, smartphones and tablets.

[Field Supply](#) ([Field Intelligence](#), hi@fieldintelligence.co) is a full-featured LMIS deployed at scale in Nigeria. It interoperates with WMS and ERP solutions used at distribution centers (eg, central or regional/state medical stores). It is available as a cloud-based SaaS with multi-user interfaces for web browsers, smartphones and tablets.

Table 1: Comparative Attributes of the Qualified LMIS Solutions

Software Solution	Requisition/Allocation	Inventory Control ¹	Warehouse Management	Asset ² Management	Performance Dashboard	Business Intelligence	Mobile App Option	Software as a Service	Cloud Hosting Only
Logistimo	✓	✓	*	✓	✓	✓	✓	✓	
OpenLMIS	✓	✓	*	✓	✓	*	*		
mSupply	✓	✓	✓	† *	✓	*	✓	✓	
Vitaliance LMIS	✓	✓	✓	*	✓	✓	✓	✓	✓
Entuition Vesta	✓	✓	✓	✓	✓	✓	✓	✓	✓
e-LMIS Medexis	✓	✓	*	*	✓	✓	✓	✓	✓
Field Supply	✓	✓	*	*	✓	*	✓	✓	✓

¹ At health facility or district store

² Inventory and functionality of cold chain equipment, diagnostic equipment, etc.

✓ Core functionality

* Achieved through interoperability with other applications

† Cold chain monitoring only in core functionality

Recommendations to the country while planning for funding LMIS

Countries have several different options for leveraging Gavi and/or Global Fund investments and funding cycles to deploy one of these qualified LMIS software solutions. However, we encourage countries to look at the following steps

1. Conduct and document an assessment of the current LMIS(s) and data use level of maturity, including evidence of routine use of supply chain data from existing systems. This should include:
 - a. Progress in implementing Supply Chain Strategies or County Improvement Plans, especially in relation to any ongoing or projected supply chain system design and data analysis/data for decision-making.
 - b. Clear and documented understanding of: what supply chain data are collected; what standard operating processes are in place and routinely used at each level of the supply chain; and whether an existing LMIS technology is in place (and its strengths and weaknesses).
 - c. Progress in optimizing/streamlining the distribution network (ie, storage hubs and transport routes) and routine supply chain processes prior to automation.
2. We encourage the countries to assess the need and develop a plan based on following parameters:
 - a. Needs and Readiness Assessment findings, including critical bottlenecks and SWOT analysis.
 - b. Long-term vision statement and strategic goals (eg, end-to-end visibility).
 - c. Estimated Total Cost of Ownership (TCO) including country co-financing.
 - d. Cost-benefit analysis comparing TCO to value of annual product distributed (ie, throughput).
 - e. Plan for administration/hosting/support/interoperability.

- f. Project and system governance structure, including project team members (from government and local partners) and project leadership (senior government officials and senior partner officials).
- g. High-level preliminary functional and system requirements (see Annex 3 for more details).
- h. Indicative phased project plan with phase 1 milestones – for example, immediate needs (like inventory management at national and subnational stores), while assuming that future phases will connect districts and health facilities (HFs), that additional features/modules will be used, etc.

If technical support is needed by the country, GF and GAVI is supportive of country requesting for such TA through Targeted country assistance Mechanism for GAVI, or similar mechanisms for GF. However, they should ensure that this TA ask is coordinated between the funding partners.

3. Commit to dedicate country resources (people, co-financing, leadership) for a two- to three-year software deployment project and sustainable ongoing operations of the LMIS. This requirement is exclusive for either organization to support this investment in countries.
4. Conduct a restricted tender from among all or some of these qualified LMIS solutions and service providers to select the one best suited to the needs and context of the country.
5. Countries which have developed their own LMIS (or want to develop) and want to invest to scale up using Gavi or GF resources need to ensure that their LMIS meets the TSS requirements.

Additional Resources

Gavi, Bill & Melinda Gates Foundation, WHO, UNICEF. 2015. Guidance on Dashboards for Immunisation Supply Chains.

<https://www.technet-21.org/iscstrengthening/uploads/guidance-on-dashboards.pdf>

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<https://www.gavi.org/sites/default/files/document/target-software-standards-for-vaccine-supply-chain-information-systemspdf.pdf>

John Snow, Inc. 2017. "Logistics Management Information Systems," in *The Supply Chain Manager's Handbook: A Practical Guide to the Management of Health Commodities*, 25-42. Arlington, Va.: John Snow, Inc.

<http://supplychainhandbook.jsi.com/>

PATH. 2010. *Common Requirements for Logistics Management Information Systems*. Seattle: PATH.

<https://path.org/resources/common-requirements-for-logistics-management-information-systems/>

Principles for Digital Development.

<https://digitalprinciples.org/>

Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Data Management*. Arlington, VA: Management Sciences for Health.

<https://www.msh.org/resources/promising-practices-in-supply-chain-management>

USAID | DELIVER PROJECT, Task Order 4. 2012. *Computerizing Logistics Management Information Systems: A Program Manager's Guide*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4.

https://www.jsi.com/JSIInternet/Inc/Common/download_pub.cfm?id=18154&lid=3

World Health Organization, PATH. 2013. *Planning an Information Systems Project: A Toolkit for Public Health Managers*. Seattle: PATH.

https://path.azureedge.net/media/documents/TS_opt_ict_toolkit.pdf

Wright, C., Drury, P., Jackson, S., Thomas, M. 2017. *Critical Success Factors for Deploying Digital LMIS*.

https://www.jsi.com/JSIInternet/Inc/Common/download_pub.cfm?id=18286&lid=3

Annex 1: Other Relevant LMIS Software Solutions

The following software solutions and vendors participated in the RFI. The Technical Evaluation Committee (TEC) determined that each one offers capacity that may be adequate in specific scenarios or contexts and can be deployed alone or in combination with one of the fully qualified software solutions to fill a specific gap.

[E2open](#) (E2open) is a commercial supply chain control tower solution with ERP functionality that interoperates with other ERP, WMS and LMIS applications to support supply chain business processes and to provide supply chain visibility and analytics. E2open is appropriate for relatively mature supply chains that have already deployed other digital LMIS at scale.

[NEC Solutions](#) (NEC) is a commercial supply chain control tower with ERP functionality that interoperates with other ERP, NEC and LMIS applications to support supply chain business processes and to provide supply chain visibility and analytics. NEC Solutions are appropriate for large distributors (eg, central medical stores) with robust business processes and national decision-makers within a relatively mature supply chain.

[Oracle Cloud Solution](#) (Oracle) is a commercial supply chain control tower solution with ERP functionality that interoperates with other ERP, WMS and LMIS applications to support supply chain business processes and to provide supply chain visibility and analytics. Oracle Cloud Solution is appropriate for large distributors (eg, central medical stores) with robust business processes and national decision-makers within a relatively mature supply chain.

mBrana ([John Snow, Inc.](#)), deployed in Ethiopia at scale and used in combination with other locally developed software applications (eg, Dagu, Fanos, Vitas), is a last-mile mobile application that supports inventory control and requisition/allocation. mBrana is appropriate for district and last-mile deployment in areas with reliable 2G or better mobile coverage.

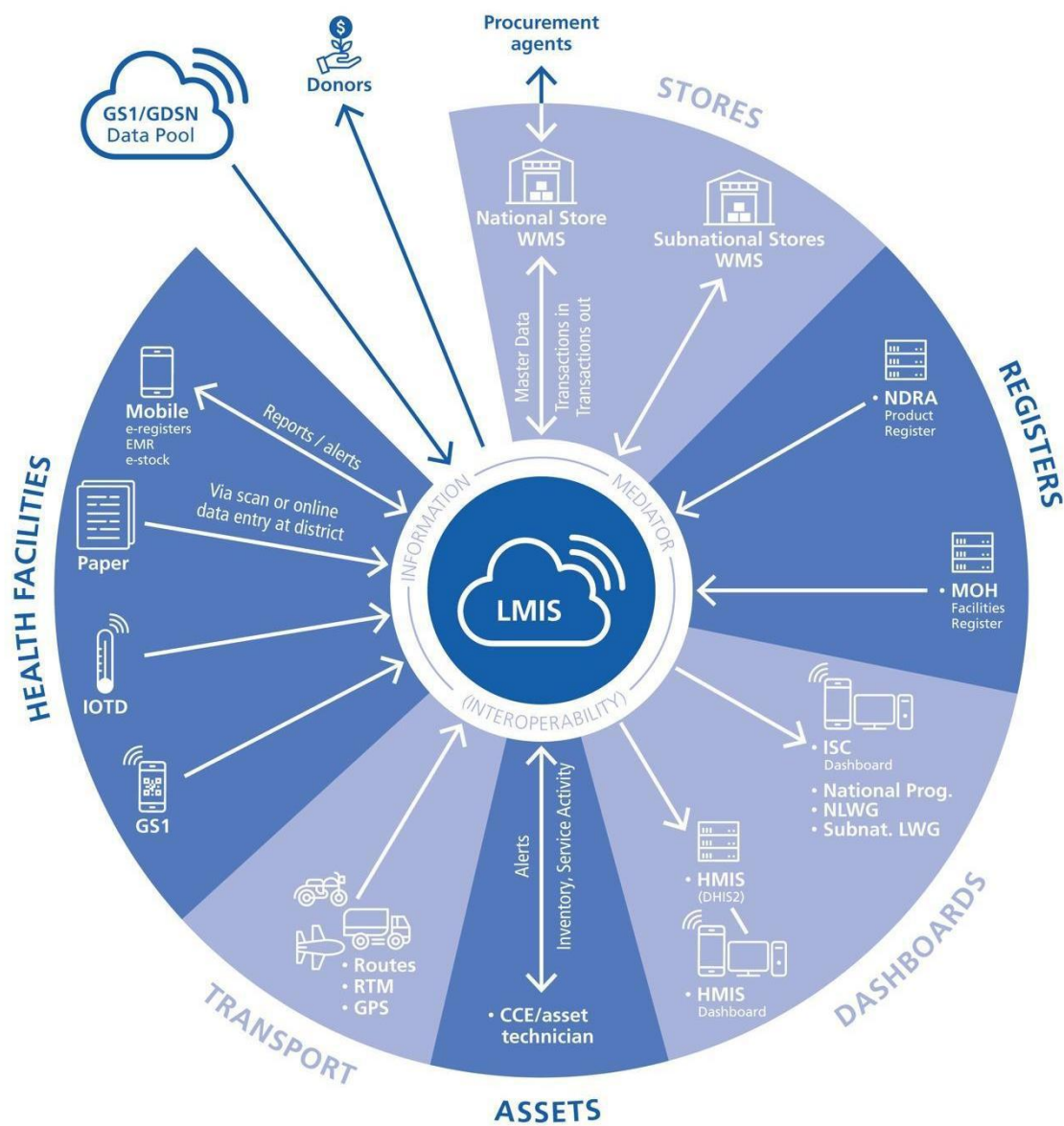
[Stock Visibility Solution \(SVS\)](#) (Mezzanine/Vodacom), deployed at scale in South Africa, is a mobile stock reporting tool appropriate for use at health facilities. SVS is appropriate for last-mile deployment in areas with reliable mobile coverage.

[Smart Paper Technology](#) (Shifo Foundation), deployed at scale in Afghanistan and Uganda, uses optimised paper-reporting forms and digital scanning technology to capture and scan data from health facilities and can be used in combination with other LMIS software solutions. Smart Paper Technology is appropriate for district-level and last-mile deployment.

[IBM Watson](#) (IBM) is a commercial artificial intelligence (AI) solution that can interoperate with ERP, WMS and LMIS applications to apply machine learning for data analysis to improve supply chain performance. IBM Watson is appropriate for relatively mature supply chains that have already deployed other digital LMIS at scale.

[DHIS2](#) (University of Oslo), deployed in over 40 countries for health service data, can be configured with its mobile application to capture supply chain data from health facilities. It can be appropriate when used in combination with a dedicated LMIS application for operational decision-making (eg, requisition/allocation, inventory control). DHIS2 can also extract supply chain data from LMIS applications to support comparative analyses of health services and product consumption trends.

Annex 2: LMIS Conceptual Model



- CCE: Cold Chain Equipment
- GDSN: Global Data Synchronisation Network
- GPS: Global Positioning System
- HMIS: Health Management Information System
- ISC: Immunisation Supply Chain
- NDRA: National Drug Regulatory Authority
- NLWG: National Logistics Working Group
- RTMD: Remote Temperature Monitoring Device
- WMS: Warehouse Management System

Annex 3: Compliance Checklist for Qualified LMIS Software Solutions

This checklist was used to assess the software solutions and service providers who responded to the Gavi-Global Fund Request for Information (RFI). Responses were verified through online demos presented by the service providers to the Technical Evaluation Committee (TEC).

PART-1: CORE FUNCTIONS	
FUNCTION	DESCRIPTION
A. DATA COLLECTION AND INTEGRATION REQUIREMENTS	System enables automated capture of essential supply chain data including period opening stock, period receipts, period end stock balance, period issues or dispensed to user data, period losses and adjustments per site/store. This data is available in transaction management tools, including electronic stock management tools, or paper-based stock keeping records or LMIS reports in country supply chain networks.
	System enables supplementary data capture, which may include batch expiry survey/tracking data, period maximum/minimum temperatures registered, inventory valuation/pricing, proof of delivery data, etc., which are available in specific function transaction management tools (including transport/fleet management tools, temperature monitoring applications/records/reports, etc.).
	System data capture options shall include: system-to-system data exchange through interoperability with existing electronic stock management tools at any level of the supply chain; import/export of Microsoft Excel reports; scanning technology for optical character recognition (OCR) of printed text and intelligent character recognition (ICR) for hand-printed text (preferred); or partial automation through manual transcription of paper-based LMIS reports and/or stock management records (minimum manual interventions are accepted as an interim measure).
	System enables integration of data captured from multiple sources into a single period dataset covering all services sites and stores in the national network at the end of the reporting period.
	System has the capacity to track data for a minimum of 10,000 items (SKUs) and 10,000 client sites with priority given to vaccines, HIV, tuberculosis, malaria, reproductive health and maternal-child products. Item names and item codes are based on the approved national catalogue with provision for essential updates/corrections.
	System is mobile-optimised for data entry and GPRS-compatible for GSM data exchange.
	System provides for asynchronous and synchronous data synchronisation option.
	System accepts data input from GS1 data matrix or barcode.
B. DATA VALIDATION AND CLASSIFICATION REQUIREMENTS	Inbuilt auto-correction and data validation; and error alerts, minimising the need for additional manual data cleaning/checks.
	System translates unstructured data from multiple sources into business-ready structured data and provides a centralised view of national supply chain data at the end of each reporting cycle.
	Provides cloud-based computing and software for data warehousing and database management; and enables access by multiple users at once.
	System enables data aggregation by administrative level, geographical region, healthcare level, disease program area or any other relevant categorisation of products and service delivery points.
C. DATA ANALYSIS, REPORTING AND VISUALISATION	System provides predictive analytics capability with appropriate algorithms to support core business processes and decision-making including: product demand forecasting; supply planning; multi-site inventory control; distribution planning or

(DASHBOARDS) AND ACCESS REQUIREMENTS	allocations management; item redistribution planning; automatic reorder point triggers; expiry warnings; cold chain asset management; temperature monitoring; etc.
	Reporting/analytics applications on the platform incorporate enhanced graphic and dashboard builders to ensure visibility of supply chain performance monitoring suitable for each user level.
	System provides early warning alerts and reminders via dashboard, email or SMS.
	System provides a menu of standard reports, analysis and dashboards that incorporate supply chain (SC) performance monitoring indicators to enable users to make informed decisions and manage supply chain risks.
	System provides an option for users to create custom reports or export data in appropriate file formats for additional analysis and utilisation.
	System analytics and reporting enable the use of data to generate the essential list of supply chain reports/dashboards below:
	- % of HFs submitting an LMIS report (SC data reporting compliance)
	- Health product availability by SKU and product type (eg, antimalarial drug, analgesic, combined oral contraceptive)
	- % of HFs stocked out (ie, where stock on hand = 0)
	- % of HFs understocked (ie, MoS < minimum stock, as per established SC guidelines)
	- % of HFs optimally stocked (ie, MoS is between minimum and maximum, as per SC guidelines)
	- % of HF overstocked (ie, MoS > maximum level as per SC guidelines)
	- MoS by product by HF/district/regional/national level by period
	- % of functional cold chain equipment
	- % of cold chain volume used/unused per unit
	- Temperature excursion rates and number
	- District/regional/national item consumption by period and consumption to caseload/coverage ratio for selected products (eg, MRDTs, HRDTs, ACTs, vaccines); this key performance indicator (KPI) requires integration/interoperability of LMIS with HMIS/DHIS2 systems
	- Product redistribution or stock imbalance reports by district/region
	- Inventory valuation reports by item by region/district/national level
	Reports incorporate geographically referenced maps and enable merging of different maps (eg, population density map merged with stock-out locations).
	System provides an option for sharing key performance reports with service delivery points (printed or by electronic mail).
	System provides access from internet-enabled mobile devices.
	System enables access to the central system from all levels of the health system.
System supports multi-user access regardless of physical location.	
System is web-enabled and capable of operating offline for routine workflows using local server or cloud-based hosting options.	
PART-2: ADDITIONAL NON-FUNCTIONAL AND TECHNICAL OPERATING REQUIREMENTS	
FUNCTION	DESCRIPTION
A. HIGH-LEVEL REQUIREMENTS	System is scalable and adapted for resource-constrained environment in which electrical power or internet connectivity disruptions are common and domestic funding is minimal or erratic.
	System provides web-based data warehousing and database management applications with standard protocol for access by external users.

	System provides geographically referenced and time-stamped data.
	System supports open data standards to facilitate data exchange with other information systems; and interoperability with other LMIS subsystems, DHIS2 and other HIS applications.
	Client team is enabled to: access and take control of user right administration, programming source codes and deployment of updates; and support simple system configurations and troubleshooting of the solution.
B. SECURITY, BACKUP & DISASTER RECOVERY REQUIREMENTS	System provides the following access features
	- Name and password control at login
	- Automatic password expiry definable
	- Stored passwords are encrypted
	- Passwords are never displayed on monitors
	- Individual control of passwords allowed; users can change their own passwords
	- Administrative central control of passwords and strong password requirements
	- Provides client ownership/control of access to national data through the administration of user rights
	- Provides an add/query/delete user function
	- Provides an add/query/delete group function
	- Provides an add/query/delete role function
	- Provides an add/query/delete access level function
	- Session expires after a predefined period
	- Account lockout after three failed log-on attempts
	- Access control of data (read, write, delete and copy) based on user roles and functionality
	- Complete transaction logging and audit trail capabilities
	Backup and disaster recovery
	- Disaster recovery and system restoration capability is established (supplier specs and recommendations are accepted)
	- Backup is done daily, weekly, monthly, etc.; items required to run backups (such as backup software, hard disk drives, external disk drives, tape drives and memory sticks) are provided and safely stored
C. SOFTWARE REQUIREMENTS	Suggested Specifications
	- Stable database supported by a suitable database management application
	- Data export/import capabilities in standard formats
	- Multi-user and standalone capabilities
	- Efficient system performance
	- Compatibility with MS Windows operating system, Linux and MacOS
	- Installation CD and source code provided (not applicable for cloud-based systems)
	- Free upgrades and updates
	- Bug and error software
	- Ownership of components clearly defined
	- Meets open data standards; source code available in hard copy and electronic media (not applicable for cloud-based systems)
	- Ownership of modifications to source code clearly defined
	- Protection of source code provided against bankruptcy, receivership, liquidation, take-over, absorption
	- Warranties available for software performance
- Agreement available for long-term maintenance and support	

D. TECHNICAL TRAINING REQUIREMENTS	Deployed working system.
	Training in functional use provided, including training instance of the system.
	System administration training provided.
	Training provided at customer site(s) and vendor site(s) defined.
	Training and training materials provided as required.
	Computer-based training software provided.
	Classroom instruction and hands-on training provided.
	Training program can be customized to meet specific customer requirements.
E. PROJECT AND CHANGE MANAGEMENT REQUIREMENTS	Supplier provides well-documented and clear project implementation plan including the risk management plan.
	Supplier provides change management and mentoring for skills transfer to client staff.
	Supplier provides names, contacts and qualifications of key implementation team experts.
	Supplier provides regular updates or briefs on project status.
	Supplier updates client business processes and standard operating procedures (SOPs) to incorporate the use of the new eLMIS solution to simplify/improve SC management.
F. COST, PRICING & SUSTAINABILITY REQUIREMENTS	Clear solution pricing structure is available (eg, list and price of equipment required; software license fees where applicable; data warehouse lease; professional fee rates for experts; local and international travel; training for known days and number).
	One-time development and deployment costs can be determined; estimated one-time costs are reasonable/competitive.
	Recurring annual and monthly operating cost structure is available.
	Incremental costs for upgrades and expansions included in operating cost. Implementation support costs identified and considered to reflect value for money.
	Training costs and days identified.
	Customization costs identified.
	Prices of other products that must be licensed or purchased for use with each product (eg, DBMS license) identified.
	Total cost of ownership established including annual operating cost per user or annual cost per site.
G. DOCUMENTATION REQUIREMENTS	Installation guide available.
	Maintenance guide available.
	System documentation available.
	Operating documentation available.
	Training documentation available.
	User documentation available.
	User and training documentation describe how to use each component in non-technical terms (eg, functional description).
	User documentation clearly defines procedures for all processes.
	System documentation includes design and setup information.
	Documentation is available in electronic format (eg, CD-ROM).
	Documentation may be maintained by the customer.
	Documentation can be copied by customer without restriction.
Documentation regularly updated and distributed.	

	Source code provided (not applicable for cloud-based systems).
	All training materials and implementation guides available online.
H. HUMAN INTERFACE REQUIREMENTS	Consistent user interface (eg, screen layouts, keyboard functions navigation).
	Good user interface design (eg, windows, icons, mouse, pull-down menus).
	Makes consistent, effective use of color.
	Data (eg, decimals, dates) entered, stored and displayed consistently.
	System provides formatting options for dates (eg, DD/MM/YY, MM/DD/YY, YY/MM/DD) that can be easily changed from one format to another and one calendar type to another (eg, Buddhist, Islamic, Gregorian, Julian, etc.).
	System provides formatting options for currency (eg, amounts formatted with commas or spaces) and supports local currencies.
	Single log-on provided for all data input.
	Menus provide access to all modules.
	Short cuts provided from one function to another without using menus.
	Context-sensitive help provided for all functionality in the system (eg, F1 from any window field).
	Descriptions of fields, their content and acceptable formats provided in the help function.
	Minimal effort required to escape from incorrect selection or system error.
	Error trapping and warning functionality included where applicable.
	Descriptions of error messages are understandable.
J. REPORTING REQUIREMENTS	Title, logos, page number, report ID, report date, run date and time are shown consistently (refer to Part I, item C. "Data Analysis" above for a menu of standard reports).
	System provides extensive formatting and print capabilities.
	Tools provided to create custom reports.
	Report-generation tools are user friendly with a short learning curve.
	System provides choice of print directly or view display on monitor and then route to printer.
	System provides ability to print multiple copies per request.
	System provides reprint reports.
	System provides ability to select specific pages of a report to print.
	System provides automated report distribution facilities.
	System provides all reports identified in the functional requirements.
System provides the ability to export reports in standard formats (eg, txt, xml).	

