**Terms of Reference (ToR)**

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| **Project Title** | Electronic Laboratory Information System (e-LIS) in Liberia |
| **Implementing Agency** | Plan International Liberia, Principal Recipient under GFTAM Grant |
| **Partner Institution** | National Diagnostics Division (NDD) |
| **Duration** | 12 Months |
| **Start Date** | Oct 2025 |

**1. Background**

The Ministry of Health (MoH) of Liberia, in collaboration with the National Public Health Institute of Liberia (NPHIL), is undertaking the development and deployment of a national Electronic Laboratory Information System (eLIS) to strengthen the collection, management, analysis, and reporting of laboratory data. This initiative aims to integrate laboratory operations across the national network, improve diagnostic turnaround times, enhance data quality, and facilitate evidence-based decision-making. The eLIS will replace fragmented and paper-based systems, ensuring interoperability with existing health information systems.

**2. Purpose and Objectives**

The purpose of this ToR is to guide the procurement and implementation of an eLIS that will ensure seamless sample and data management from pre-analytic to post-analytic phases, integrate with DHIS2, improve quality control, and enhance laboratory efficiency across Liberia. The specific objectives include:

* To provide a user-friendly sample-centric e-LIS.
* To provide and configure the necessary infrastructure required to host the system and for end-user accessibility.
* To ensure the system supports data interoperability and integration with DHIS2.
* To enhance laboratory workflows, including sample management, result reporting, and quality control.
* To provide training and support to laboratory staff for effective system utilization.
* To ensure sustainability by transitioning plans for e-LIS support and maintenance to local in-country resources, with low long-term costs and HR requirements for using the system.

**3. Scope of Work**

The scope of work covers the design, supply, installation, configuration, and commissioning of a comprehensive Electronic Laboratory Information System (e-LIS) to meet the functional, technical, and integration requirements of the national laboratory network.

The proposed eLIS solution should meet the following requirements:

* **Comprehensive Record Management:** Capture and log all records for every specimen entering the laboratory to ensure complete traceability from receipt to final result.
* **Integration for Sample Tracking:** Enable seamless integration with a digital sample tracking and transport system, allowing electronic transmission of sample information from clinical sites when such a system is implemented.
* **Centralized Data Sharing:** Support integration with centralized databases such as DHIS2, ensuring real-time data transmission to facilitate timely, evidence-based decision-making.
* **Enhanced Functionalities:** Provide multiple critical capabilities, including:

1. Inventory management
2. Results communication and reporting
3. Monitoring and management of internal quality controls
4. Tools for overall laboratory performance tracking and reporting

A phased approach to the implementation will be followed.

* **Phase 1** will involve initial engagements between the service provider and government entities for developing the detailed technical and operational plans, including defining architecture of the platform, infrastructure, upgrades, initiate procurement of hardware, design/review of standardized forms (eg sample requisition forms), the human resource plan for training and the uptake as well as oversight and financial mechanisms.
* **Phase 2** will involve pilot deployment of the proposed solution in the following five laboratories where each site will require the LIS solution to comprehensively interface with all relevant clinical diagnostic instruments and will be equipped with a minimum of twenty front-end PC stations to adequately support efficient laboratory data management and workflow processes:
  + National Reference Laboratory (NRL), Monrovia
  + Redemption Hospital, Monrovia
  + James David Junior Hospital, Monrovia
  + Jack F. Doe Memorial Hospital, Nimba
  + Phebe Hospital, Bong
* **Phase 3** will involve the evaluation of the pilot and lessons learnt with recommendations for roll-out to other laboratories
* **Phase 4** will be rolling out to 30 laboratories across the country. The details of the laboratories will be provided before phase 4 implementation.

In addition to the full e-LIS, it is recognized that some laboratories particularly at lower tiers of the health system may currently lack the infrastructure (e.g., adequate hardware, stable internet connectivity) required for immediate implementation.

To address this gap, the scope also includes the consideration of complementary or supporting digital solutions that can serve as interim digitalization tools. These tools should:

* Enable laboratories with limited resources to begin digitizing key data points immediately
* Provide a low-cost, scalable bridge until full e-LIS deployment becomes feasible
* Leverage AI and smartphone technology for digitizing paper-based data where applicable
* Be designed for ease of use in low-resource settings
* Require minimal hardware and offer offline capabilities with synchronization once connectivity is available
* Ensure alignment with national data strategies and interoperability with DHIS2

Proposals under this scope may therefore address:

1. A complete e-LIS solution as described above.
2. A supporting/bridge solution to facilitate interim digitization for facilities not yet ready for full deployment.

The selection and implementation approach will be based on relevance, feasibility, and alignment with the national laboratory and health information system strategy.

**4. Technical Specifications**

**4.1 High Level Technical Requirements**

The proposed e-LIS must be technically robust, scalable, and adaptable to the diverse operating environments found across Liberia’s laboratory network. The technical requirements are designed to ensure seamless integration, system security, performance reliability, and long-term sustainability.

At a high level, the system is expected to meet the following technical criteria:

* System Architecture: The solution should provide a modular, scalable architecture that supports deployment at multiple levels—national, regional, and local laboratories. Cloud-hosted or hybrid architectures that minimise infrastructure burdens while ensuring data availability and resilience will be preferred.
* Interoperability Standards: Full compliance with international data exchange standards such as HL7, ASTM, and FHIR is required to facilitate interoperability with diagnostic instruments and national systems including DHIS2 and e-LMIS.
* Data Security and Privacy: The system must incorporate robust data protection measures, including encryption of data at rest and in transit, secure user authentication, and audit logging, in compliance with local and international standards for health information security
* Performance and Reliability: The system should maintain high availability and performance under variable network and hardware conditions, particularly in rural and low-resource settings. Proposals must specify expected uptime, failover mechanisms, and system redundancy features.
* Scalability and Flexibility: The architecture must support horizontal and vertical scaling to accommodate increases in data volume, users, and facility coverage over time, with minimal disruption.
* Device and Browser Compatibility: The solution must be compatible with standard operating systems and browsers (e.g., Windows, Linux, Chrome, Firefox) and accessible via both desktop and Android-based devices.
* Offline Functionality and Synchronization: Particularly critical for laboratories with intermittent internet access, the system should include offline capabilities with local data storage and automated synchronization once connectivity is restored.
* Customisability and Localisation: The platform should allow for customisation of workflows, forms, reports, and dashboards to match national protocols and specific laboratory requirements. French-language support is mandatory, and other local language options are desirable.
* Deployment, Maintenance, and Support: Vendors should outline the technical prerequisites for installation, hosting, and maintenance, as well as the tools and processes provided for remote monitoring, troubleshooting, and regular updates/upgrades.
* For interim/bridge solutions, proposals should describe how collected data can be synchronized or migrated into the national e-LIS once full system implementation is in place, ensuring data continuity and reducing duplication of effort.

**4.2 Functional Requirements for End Users**

The proposed e-LIS must support the following core functional areas:

1. User and access management: System user permissions, audit logging, user authentication that ensures the following:
2. A role-based access
3. A unique user ID and password for system access
4. Allow authorized users to create user profiles
5. Allow authorized users to search for user profiles
6. Allow authorized users to modify user profiles
7. Allow authorized users to delete user profiles.
8. Patient and sample source management: The proposed system must facilitate complete pre-analytic processes that will link samples to the analytic system; thus, it should be able to:
9. Provide or accept a unique sample ID
10. Create a sample profile
11. Modify a sample profile
12. Delete a sample profile
13. Search for a sample profile
14. Check and flag for duplicates.
15. Intra-laboratory - specimen management: Within the laboratory the system must be able to fulfill the following:
16. Register a specimen
17. Enter specimen identifiers from bar code labels
18. Associate a specimen with a patient and/or source
19. Create pending sample list
20. Modify a specimen
21. Delete a specimen
22. Order management, test configuration and reporting: The system must have the ability to facilitate configuration of tests, result entry (manual or automated), validation workflows, and support for printing and electronic dissemination of results mentioned below but not limited to:
23. Support tests requests
24. Create a test request for a specific client or specimen
25. Associate a specimen with the request
26. Modify test request
27. Search for a request
28. Delete a request
29. Check for duplicate requests
30. Allow test result accessibility.
31. System Management, interfacing and integration: The system provided must be able to have direct or middleware-enabled connectivity with diagnostic platforms (e.g., GeneXpert, PCR systems, haematology, blood transfusion, microbiology and chemistry analysers), enabling automated data capture and reducing transcription errors. At a minimal level this integration must allow:
32. Link to patient registry, if it exists for example HIV VL/TB register
33. Identification of data source (GPS location)
34. Ad hoc query capability
35. Keep error logs
36. Keep log-in information
37. Archiving records
38. Linking/interfacing ability to other standard databases (e.g., a hospital or health information system)
39. Data export in acceptable formats
40. Alert functionality
41. Allow for basic data analysis
42. Allow for report generation
43. Data use, post analytics, reporting and results management: The system must allow near-real-time dashboards, configurable reports (aggregate and individual), and support for mandatory reporting to DHIS2. Tools for monitoring turnaround times, test volumes, and lab performance indicators. Thus, it must provide seamless post analytic processes and allow integration with:
44. Analytic or BI dashboards
45. Electronic communication of results to the clinical user including SMS
46. Inventory and supply management: The system must allow the management of reagents, consumables, and equipment stocks, aligned with laboratory workflows, with the option for integration with the national logistics management information system (LMIS).
47. Quality Control and Assurance: The system must allow the monitoring and documentation of internal and external quality control activities, including flagging of abnormal values and audit trail logging.
48. Offline Functionality and Synchronization: The system must have the ability to operate in environments with intermittent connectivity, with queuing and syncing of data once access is restored.
49. Storage / Backup
50. Provide appropriate backup capabilities
51. Ensure restore from back up can be done

**5. Deliverables and Timelines**

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| **No.** | **Activity** | **Instructions** | **Deliverable** | **Timeline** |
| **Phase 1** | | | | |
| 1 | Define overall strategies, methodology, actions, and implementation plan. | Engage with NDD/NPHIL to develop and document the overall approach, methodology, detailed actions, work plan, quality standards, and governance structure for implementing the LIS. | Approved inception report with detailed plan. | Month 1 |
| 2 | Assess existing health information systems for integration and identify required hardware/software. | Review existing health information systems, assess integration feasibility, identify hardware/software requirements, and document findings. | Assessment report with integration requirements and hardware list. | Month 1 |
| 3 | Interface eligible laboratory instruments with LIS. | Identify all LIS-compatible instruments in pilot sites, establish connections, and configure for automated data transfer. | Instrument interfacing report with list of connected equipment. | Month 2 |
| 4 | Configure and submit first version (MVP) of LIS with required modules and functionality. | Customize LIS modules, configure workflows, load master data, and submit for stakeholder review. | MVP deployed for review; stakeholder meeting minutes documenting feedback. | Month 3 |
| 5 | Integrate existing information systems identified during assessment. | Develop and implement integration mechanisms to transfer required data points between LIS and existing systems (e.g., DHIS2, eLMIS). | Integration report with data points, test results, and validation sign-off. | Month 4 |
| 6 | Develop test scripts to validate LIS modules and integrations. | Prepare detailed, step-by-step test scripts for all LIS functions and integrations, specifying expected outcomes. | Approved test script document with step-by-step actions and expected results. | Month 5 |
| 7 | Conduct User Acceptance Testing (UAT) at selected facilities representing varied infrastructure conditions. | Run UAT in diverse pilot sites, gather feedback on functionality, usability, and performance, and log all issues. | UAT report with results, user feedback, and recommended improvements. | Month 6 |
| 8 | Prepare comprehensive LIS system documentation, including architecture, source code, and FAQs. | Develop full system documentation including technical design, architecture diagrams, and operational guides. | Complete system documentation package delivered to NDD. | Month 6 |
| **Phase 2** | | | | |
| 9 | Deploy LIS in 5 pilot laboratories to assess full functionality. | Install and configure LIS in pilot sites, provide training, and monitor performance. | Pilot deployment report with feedback and improvement recommendations. | Month 8 |
| **Phase 3** | | | | |
| 10 | Evaluate pilot results and recommend changes. | Analyze pilot performance data, identify gaps, and prepare recommendations for adjustments. | Pilot evaluation report with lessons learned and solution proposals. | Month 9 |
| 11 | Apply fixes and improvements from UAT and pilot feedback. | Implement corrective actions and enhancements based on pilot and UAT findings. | Updated LIS ready for rollout. | Month 9 |
| 12 | Conduct final system clean-up prior to national deployment. | Optimize configurations, clean data, and prepare the system for installation in all remaining sites. | Optimized LIS ready for installation. | Month 10 |
| 13 | Develop final user manuals and SOPs. | Prepare comprehensive user guides and SOPs covering all LIS operations and troubleshooting. | Approved manuals and SOPs distributed. | Month 10 |
| **Phase 4** | | | | |
| 14 | Roll out LIS to remaining laboratories. | Install, configure, and test LIS in all targeted facilities, ensuring readiness for operations. | LIS deployed in all target facilities. | Month 11 |
| 15 | Develop LIS maintenance structure for ongoing support. | Define technical support processes, escalation protocols, and maintenance schedules. | Approved maintenance and escalation plan. | Month 11 |
| 16 | Conduct stakeholder sensitization and validation of final system. | Engage stakeholders to present the final LIS, demonstrate functionalities, and obtain validation. | Stakeholder validation report. | Month 12 |
| 17 | Deliver knowledge transfer and training to facility managers, end-users, super users, and IT staff. | Conduct structured training programs and hand over all technical documentation. | Training completion report and sign-off. | Month 13 |
| 18 | Provide system support framework for post-deployment operations. | Establish on-site and remote support arrangements with designated local partners. | Post-deployment support plan with local capacity arrangements. | Month 14 |
| 19 | Develop sustainability plan for full in-country support within 5–10 years. | Create a roadmap for transitioning LIS management fully to national teams, minimizing long-term costs. | Approved sustainability plan. | Month 15 |

**8. Key Performance Indicators (KPIs)**

The implementation of eLIS will be monitored against the following KPIs:

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| **S.no** | **KPI** | **Target** |
| 1 | System Uptime | ≥ 99% during operational hours |
| 2 | Integration Success Rate | ≥ 95% of eligible instruments integrated successfully |
| 3 | Turnaround Time Reduction | ≥ 30% improvement in diagnostic result turnaround in pilot sites. |
| 4 | Training Coverage | 100% of intended users trained before go-live at each site |
| 5 | User Satisfaction | ≥ 80% satisfaction score in post-implementation survey. |

**9.** **Qualification Criteria**

* Minimum 5 years proven experience in the design, customization, and deployment of Laboratory Information Systems (LIS) or similar health information systems.
* Demonstrated experience implementing LIS solutions in low-resource settings or in Sub-Saharan Africa at a national scale.
* Evidence of successful integration of LIS with other health information systems such as DHIS2, eLMIS, or EMRs.
* Demonstrated expertise in data security, including encryption, role-based access, and audit trails

**9. Project Oversight**

The contract will be managed jointly by the National Diagnostics Division, Ministry of Health and Plan International Liberia, with oversight provided by the Wits Consortium.