CARISCA Centre for Applied Research
and Innovation in Supply Chain – Africa

Policy Brief

Enhancing Health Commodity Supply Chain Visibility through GhiLMIS: Impact, Challenges, and Critical Success Factors

Authors:

- John Serbe Marfo, PhD
- Henry Ataburo, PhD
- Afia Frimpomaa Asare Marfo, PhD
- Ivan Mozu, PhD
- Pasty Asamoah

December, 2023

USAID FROM THE AMERICAN PEOPLE

ASU Arizona State University

KNUST KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

EXECUTIVE SUMMARY

Visibility in the healthcare supply chain is crucial for achieving universal health coverage. The Ghana Integrated Health Logistics Management Information System (GhiLMIS), introduced in 2017, aims to enhance this visibility. This report evaluates GhiLMIS's impact, challenges, and key success factors based on user interviews at regional medical stores (RMSs) and service delivery points (SDPs). Findings indicate that GhiLMIS has significantly **improved end-to-end visibility**, enabling data-driven decision-making, reducing stock-outs, and tracking expiration of healthcare commodities. The system has streamlined the requisition process, enhancing medicine availability and care quality. **Challenges** include weak internet connectivity, lack of system interoperability, limited staffing, and requisition anomalies. **Key success factors** include user integration, enhanced logistics capacity, improved IT skills, task-technology fit, and system interoperability. Recommended actions include integrating GhiLMIS with other healthcare systems, appointing dedicated GhiLMIS staff at SDPs, and developing offline/mobile versions to address connectivity issues. Investments in telecommunication infrastructure, strengthening healthcare human resources, and designing systems for user ownership are essential policy directions.

BACKGROUND

Ghana's public sector health commodity supply chain can be viewed from two levels. At the strategic/national level, the MoH, Ghana Health Service (GHS) and the development partners collaboratively formulate and implement policies, and jointly source and procure commodities for the central medical store (CMS).
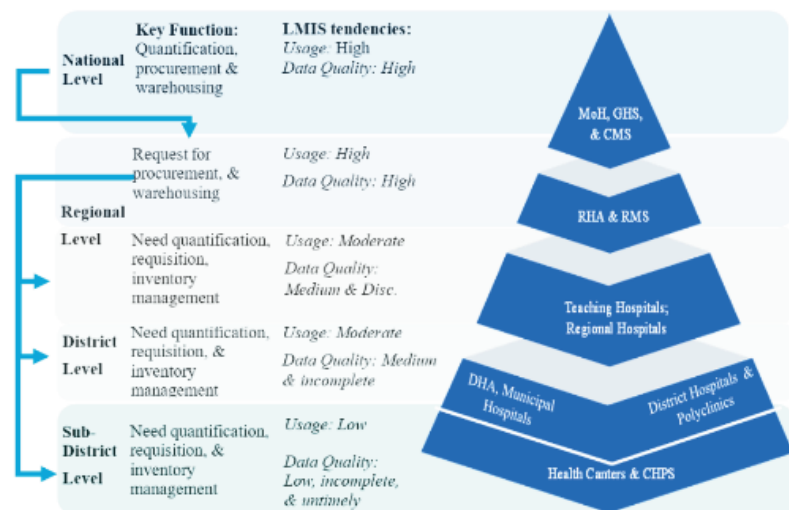
Figure 1. Health commodity flow

At the operational level, health commodities move from the CMS through the RMSs to the SDPs (Bossert et al., 2004) by a pull supply chain mechanism. Figure 1 depicts the health commodity supply chain structure, business processes, and the LMIS tendencies at each level.

Healthcare commodity consumption data originates from SDPs, which GhiLMIS is designed to capture and make visible to all actors across the network in real time to support decision-making and forecasting. On the other hand, patient and clinical data flows from SDPs through DHAs and RHAs, and to the national level using the LHIMS and DHIMS II, respectively. All three sets of data generated at the SDPs are interrelated but currently managed with different systems without data synchronization, limiting visibility. In late 2011, the Ministry of Health (MoH) initiated a team to develop the Health Commodity Supply Chain Master Plan (SCMP) to enhance the efficiency of healthcare commodity management (MoH, 2018). Four of the SCMP's priority areas focus on health commodity supply chain enhancement. In 2017, the MoH and the Ghana Health Service (GHS), with support from development partners, launched the GhiLMIS, which aims at coordinating demand and supply chain processes effectively by capturing, storing, and sharing medical commodity data/information from all levels to foster decision-making, planning, and forecasting.
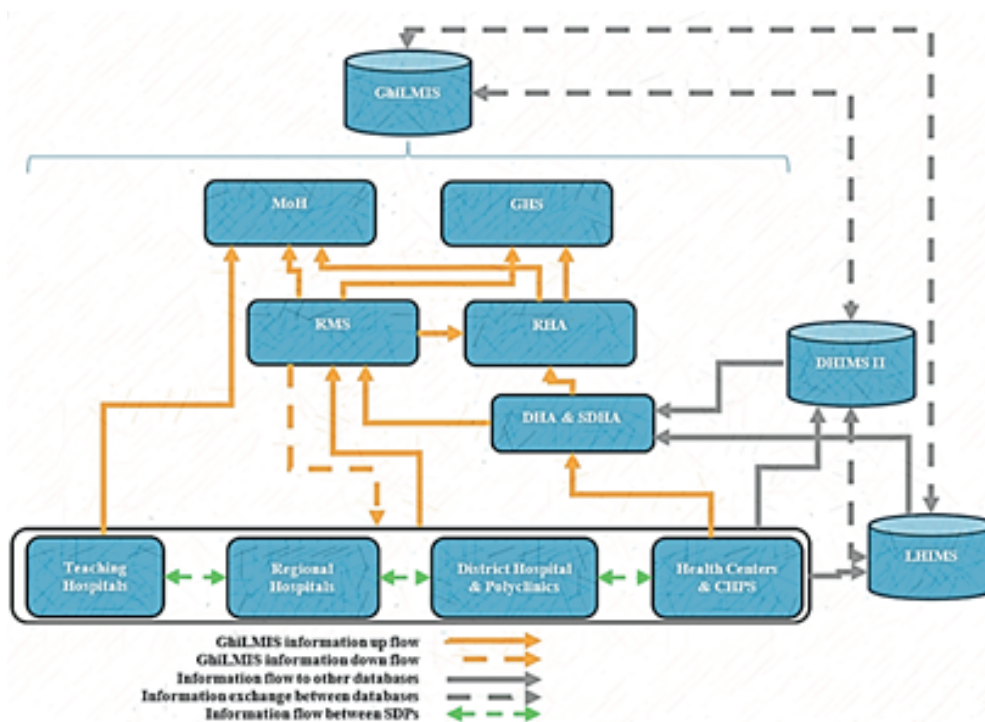
Note: Broken line – lack of data synchronization
Figure 2. Health commodity information flow

LMIS IN THE HEALTHCARE SUPPLY CHAIN

Healthcare Supply Chain Complexity

The healthcare supply chain is uniquely complex, unpredictable, and requires high responsiveness (Benzidia et al., 2019). Thus, efficient management is crucial for accessing health commodities, achieving universal healthcare coverage, and maintaining care quality (Bergum et al., 2017). However, this depends on the LMIS's ability to provide end-to-end visibility and optimal commodity management across the supply chain.

Challenges in Healthcare LMIS Projects

Low data quality, including discrepancies and incompleteness, is a significant issue in healthcare LMIS projects in developing economies (Rumisha et al., 2018). Additionally, low staff commitment, lack of support logistics, frequent stock-outs, and centrally controlled LMIS systems reduce data reusability and interoperability (Ughweroghene et al., 2017).

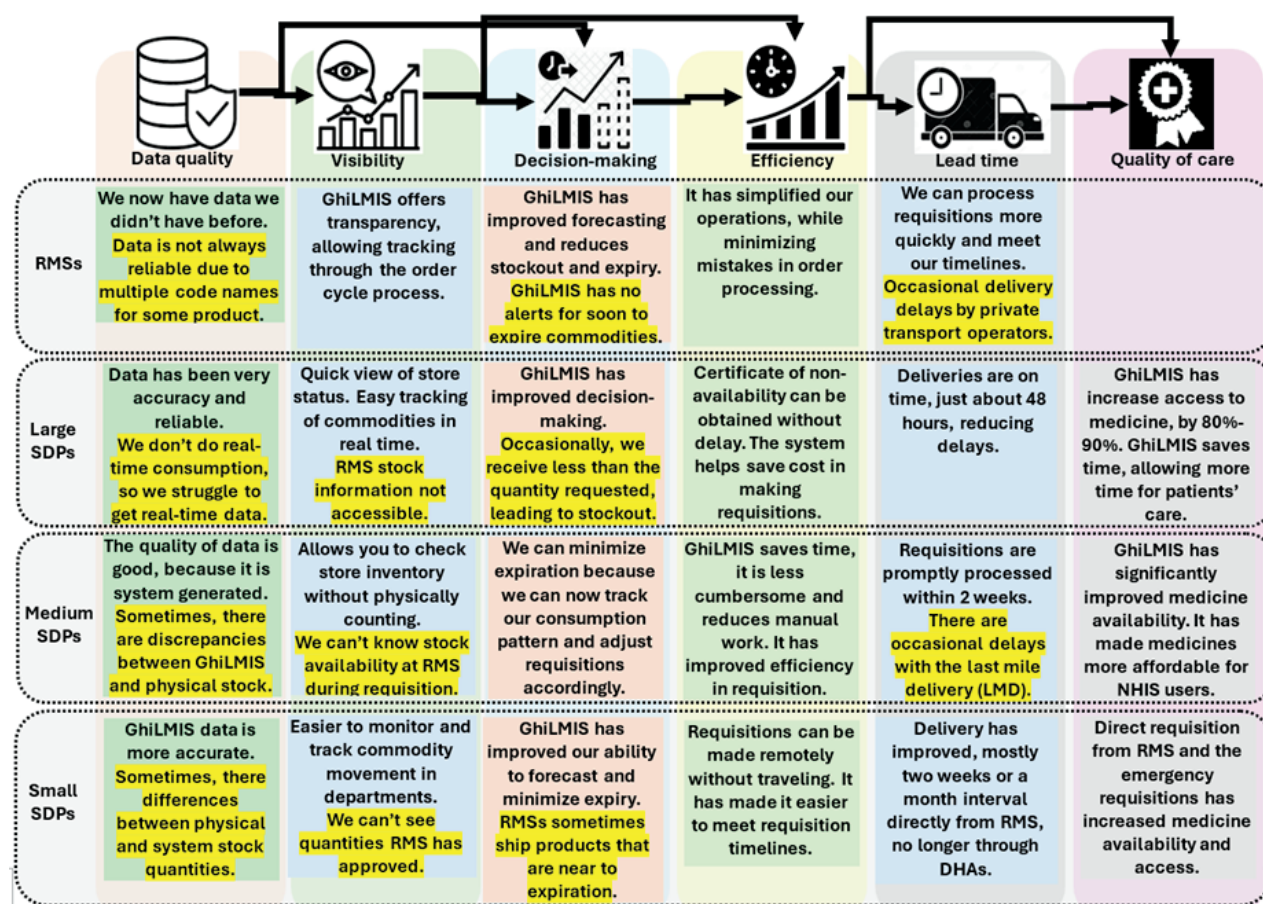## Fragmentation in Ghana's Health Supply Chain

Ghana's health supply chain is fragmented, with frequent stock-outs of essential medicines (USAID, 2020; Global Fund, 2016). Current siloed computerized LMISs in the sector make it difficult to capture, synchronize, and share data across Ghana's healthcare supply chain (MoH, 2018). A nationwide integrated LMIS (GhiLMIS) was needed to cover all logistics management processes.

Why GhiLMIS?

GhiLMIS was designed to capture real-time consumption data and make it visible across the network. GhiLMIS has been operational for five years. However, a comprehensive evaluation of GhiLMIS's impact on healthcare commodity management has not been done. This policy brief presents empirical results on GhiLMIS's impact, challenges, success factors, and policy implications for healthcare management in Ghana.

GhiLMIS has made it possible to capture, store, retrieve, and share commodity data such as availability, consumption, expiry, and movement in the healthcare supply chain. These have impacted decision-making, efficiency, lead times, and quality of care.

	Data quality	Visibility	Decision-making	Efficiency	Lead time	Quality of care
RMSs	We now have data we didn't have before. Data is not always reliable due to multiple code names for some product.	GhiLMIS offers transparency, allowing tracking through the order cycle process.	GhiLMIS has improved forecasting and reduces stockout and expiry. GhiLMIS has no alerts for soon to expire commodities.	It has simplified our operations, while minimizing mistakes in order processing.	We can process requisitions more quickly and meet our timelines. Occasional delivery delays by private transport operators.	
Large SDPs	Data has been very accuracy and reliable. We don't do real-time consumption, so we struggle to get real-time data.	Quick view of store status. Easy tracking of commodities in real time. RMS stock information not accessible.	GhiLMIS has improved decision-making. Occasionally, we receive less than the quantity requested, leading to stockout.	Certificate of non-availability can be obtained without delay. The system helps save cost in making requisitions.	Deliveries are on time, just about 48 hours, reducing delays.	GhiLMIS has increase access to medicine, by 80%-90%. GhiLMIS saves time, allowing more time for patients' care.
Medium SDPs	The quality of data is good, because it is system generated. Sometimes, there are discrepancies between GhiLMIS and physical stock.	Allows you to check store inventory without physically counting. We can't know stock availability at RMS during requisition.	We can minimize expiration because we can now track our consumption pattern and adjust requisitions accordingly.	GhiLMIS saves time, it is less cumbersome and reduces manual work. It has improved efficiency in requisition.	Requisitions are promptly processed within 2 weeks. There are occasional delays with the last mile delivery (LMD).	GhiLMIS has significantly improved medicine availability. It has made medicines more affordable for NHIS users.
Small SDPs	GhiLMIS data is more accurate. Sometimes, there are differences between physical and system stock quantities.	Easier to monitor and track commodity movement in departments. We can't see quantities RMS has approved.	GhiLMIS has improved our ability to forecast and minimize expiry. RMSs sometimes ship products that are near to expiration.	Requisitions can be made remotely without traveling. It has made it easier to meet requisition timelines.	Delivery has improved, mostly two weeks or a month interval directly from RMS, no longer through DHAs.	Direct requisition from RMS and the emergency requisitions has increased medicine availability and access.

- **Data quality:** Data quality has considerably improved in completeness, accuracy, consistency, and accessibility. However, delays in entering consumption data by SDPs reduce data currency.

- **Visibility at RMS:** GhiLMIS has improved visibility in the requisition cycle. Notwithstanding this, SDPs are restricted from viewing RMS stock capacity and product expiry information at the requisition point.

- **Improved decision-making:** GhiLMIS has improved decision-making and forecasting, resulting in reduced stock-outs and commodity expiration to a greater extent. Nevertheless, restricted access to RMS stock information and occasional receipt of products nearing expiry from RMS are major drawbacks.

- **Increased efficiency:** Electronic requisition with GhiLMIS saves time and cost associated with healthcare commodity management.

- **Shorter lead times:** With GhiLMIS, requisition lead time has been shortened. It is now about a 2-day cycle time for large SDPs, 1 to 2 weeks for medium SDPs, and about 2 to 4 weeks for small SDPs, depending on proximity to RMS. Delays often result from private van operators in the last-mile delivery (LMD) phase.

- **Improved quality of care:** GhiLMIS contributed to the overall quality of care by contributing to medicine availability, easy access to medicine, increased time for caregiving, and affordability of medicines.

Finding - 2. Challenges

One fundamental challenge with GhiLMIS is its heavy dependence on strong internet connectivity. Unfortunately, internet connection is not an exclusive challenge to community health planning and services (CHPS) compounds and SDPs in remote locations, but also SDPs in the cities. Other operational challenges are system-related, such as SDPs' limited staff capacity and restricted access to RMS stock information [See Annex 1].

- **Weak internet connectivity:** Poor network coverage hinders internet accessibility for RMS and SDPs alike but is more severe for those located in remote areas.

- **System-specific challenges:** The lack of interoperability between GhiLMIS and LHIMS requires users to manually input the same consumption data into both systems. Occasional system malfunctioning/crashing and frequent user password reset requirements on GhiLMIS are inconvenient.

- **Data/information quality issues:** Lack of standardization in naming some commodities in the system presents a challenge for users. Restricted visibility of RMSs' stock information and delays in entering consumption data make it difficult to rely on system data.

- **Limited computer access** Most SDPs have limited access to computers, hence some GhiLMIS users rely on personal computers or must borrow from co-workers.

- **Limited staff capacity:** Most SDPs are understaffed in the pharmacy and nursing units, which puts much strain (increased workload) where GhiLMIS is operated by pharmacists and nurses, as is the case in most SDPs and more vivid for CHPS.

- **Distant technical support:** GhiLMIS users must consult regional and national experts whenever they encounter challenges with the system. This is often associated with delays in addressing the user's challenges.

- **Requisition issues:** Most facilities reported that they occasionally receive less than the quantities of commodities they request from the RMS. Sometimes, the RMS delays the approval of a certificate of non-availability.

Finding - 3. Critical Success Factors

Success factors identified were classified under five major themes: technology factors, project characteristics, organizational characteristics, task characteristics, and user and social characteristics [see Figure 3].

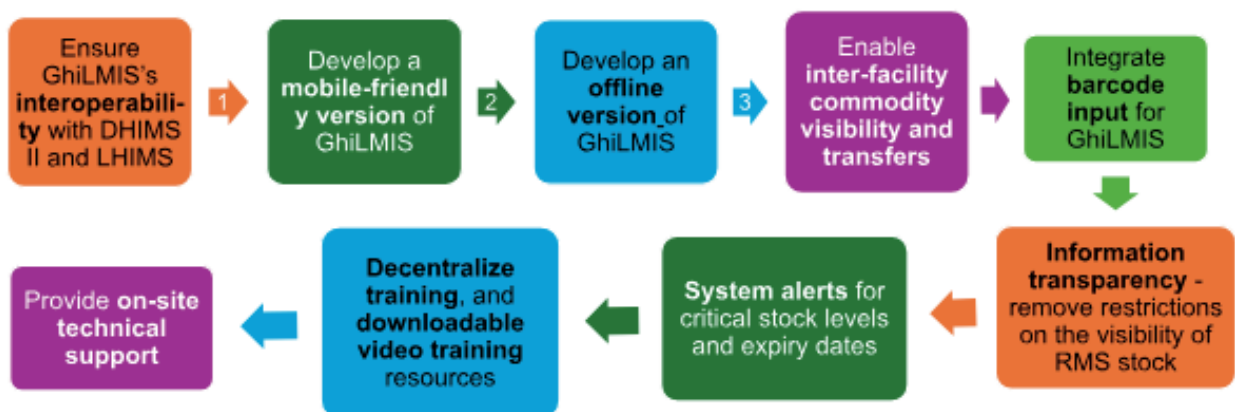| Critical success factor	Best practice	Lessons learned
CSF1. All-inclusive project execution	User involvement in project implementation and the gradual rollout of the project.	User involvement at the planning phase and incentives are key to system success.
CSF2. Supportive technology	Interface friendliness, data quality, and technical support.	Easy login, information transparency, and proximal tech support will be needed.
CSF3. Organizational readiness	Support from SDP management in providing users with requisite logistics.	Strengthening SDPs' staffing capacity and IT infrastructure will be needed.
CSF4. Task and technology fit	GhiLMIS fits well with the requisition cycle activities, which is critical to ensuring medicine availability.	Data synchronization with LHIMS is necessary to avoid task duplication.
CSF5. Social & user characteristics	Peers lending their laptops to facilitate GhiLMIS activities, and GhiLMIS training programs to enhance users' abilities.	Training staff on GhiLMIS can benefit the system. Frequent refresher courses, downloadable video lessons, and IT skills enhancement for users are required.
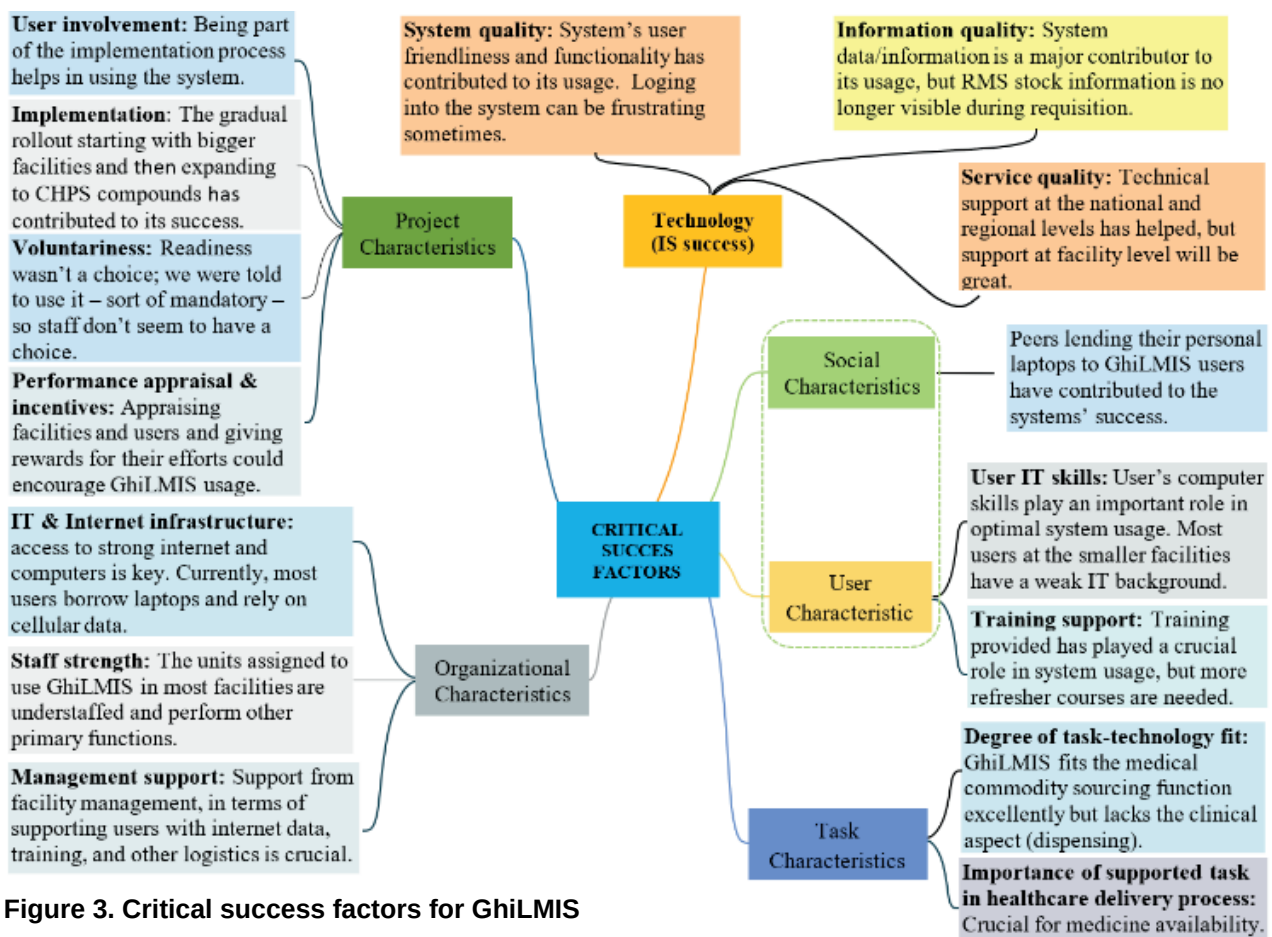
Figure 3. Critical success factors for GhiLMIS

Performance appraisal with reward systems for GhiLMIS users: GhiLMIS adds extra responsibility and costs for medical staff, as some must use personal resources like cellular data and laptops. Recognizing their efforts with rewards can encourage effective system use and timely updates, improving data quality and overall system success.

Appoint dedicated staff (team) for GhiLMIS at each SDP: Low system usage and data quality are due to staff shortages at SDPs, leading to sporadic GhiLMIS updates. Appointing dedicated staff to manage GhiLMIS at each facility can ensure consistent and effective system use.

Enable onboarding of open market suppliers onto GhiLMIS: Facilities cannot currently onboard open market suppliers into GhiLMIS, causing invoicing issues and requiring manual records for audits. Allowing these suppliers to join GhiLMIS can improve validation, regulation, and auditors' reliance on GhiLMIS records.

CALL TO POLICY ACTION

Prioritize investment in telecommunication infrastructure: Weak internet connectivity is a major challenge for GhiLMIS users, especially in remote areas. To support GhiLMIS and similar projects, Ghana's government must invest in telecommunication infrastructure.

Embark on human resource capacity development in the healthcare sector: Limited staffing capacity hinders optimal GhiLMIS use at SDPs, as pharmacists and nurses manage it alongside their primary duties. Government policies should focus on developing human resource capacity to accommodate GhiLMIS activities.

System design for user ownership: User alienation in project planning and execution hinders the success of national ICT projects like GhiLMIS. To ensure sustainability across political regimes, these projects should promote system ownership by involving supervisors at lower levels and adopting a bottom-up approach. This strategy can enhance user acceptance and commitment.

ANNEX 1

Internet Network related	Staffing related	Access to computer	System related	Data quality related	Technical support related	Requisition related

"The main challenge is the **network**" [RMS]

"**... data quality isn't guaranteed** ... multiple formulation and **codes** for the same drug" [RMS]

"I live in Accra, where internet is supposed to be very reliable, but sometimes we really **struggle**" [Large SDP]

"We need more people to be trained to use GhiLMIS as the **workload is very heavy for our limited staff**" [Large SDP]

"... it's a bit too **demanding** for those who are not good with computers ... there's no **interoperability** between GhiLMIS and LIMS" [Large SDP]

"Due to internet problems, some **activities are logged days after physical transactions,** affecting real-time data accuracy." [Large SDP]

"... open market suppliers are not on the system, causing **issues with invoicing.** Sometimes you request 100 units, but they **only provide 50 units**" [Large SDP]

"... sometimes we **use cellular data ... poor network connectivity** in some areas affects accessibility ... network is unreliable, often **requiring late-night work**" [Medium SDP]

"... with our **workload,** we could not consume and receive some items in the system because we felt it was just a duplication" [Medium SDP]

".. we have **limited laptops and desktops** ... we have to **borrow laptops** to work efficiently" [Medium SDP]

" LIMS was **not integrated** with GhiLMIS, leading to **duplication of work** ... occasional system **slowness** ... **manual entry** of drug codes" [Medium SDP]

"... **can't access RMS stock data** through GhiLMIS at the time of requisition ... there are **duplicate entries for certain products,** making it difficult to find the right one" [Medium SDP]

"... we **don't have immediate technical support** within the facility ... if there's any issue, **we always have to go back to the regional level**" [Medium SDP]

"... when we request commodities, **we don't get like 40-35%** of our commodities" [Medium SDP]

"... if you're using cellular data, everything goes down once you get a call. ... I'd like to mention that the **system's data consumption is high**" [Small SDP]

"I'm the same person at the stores and at the dispensary, so I have to **repeat entry of consumption in GhiLMIS** ... the person who went for the training will tell you she's **not good with IT**" [Small SDP]

"... those of us who received tablets during the training can't use them effectively. We have to **rely on a single laptop** for all our work, which is inconvenient". [Small SDP]

"I don't even know **how to consume properly** ... Sometimes I'm very sure of **the username and password** yet it will tell me it's wrong and **needs to be reset**" [Small SDP]

"... we know sodium chloride dextrose but in GhiLMIS they use glucose ... [e.g.] I saw IV metronidazole, injection metronidazole and intravenous metronidazole, personally, **I got confused.**" [Small SDP]

"Sometimes they will approve your requisitions but **deliver nothing** ... sometimes before they will approve the **certificate of non-availability**, the next requisition will be due" [Small SDP]

References

Benzidia, S., Ageron, B., Bentahar, O., & Husson, J. (2019). Investigating automation and AGV in healthcare logistics: a case study-based approach. *International Journal of Logistics Research and Applications*, 22(3), 273–293. https://doi.org/10.1080/13675567.2018.1518414

Bergum, B. I., Nielsen, P., & Sæbø, J. I. (2017). Patchworks of logistics management information systems: Challenges or solutions for developing countries? *IFIP Advances in Information and Communication Technology*, 504, 47–58. https://doi.org/10.1007/978-3-319-59111-7_5

Bossert, T., Bowser, D., Amenyah, J., & Copeland, R. (2004). *Ghana: Decentralization and Health Logistics Systems:* Arlington, Va.: John Snow, Inc./DELIVER for USAID for the U.S. Agency for International Development.

Ministry of Health. (2018). *Ghana Health Commodity Supply Chain Master Plan: Logistics Management Information System Assessment Report.* https://www.moh.gov.gh/wp-content/uploads/2018/02/LMIS-ASSESSMENT-REPORT.pdf

Rumisha, S. F., Lyimo, E. P., Mremi, I. R., Tungu, P. K., Mwingira, V. S., Mbata, D., Malekia, S. E., Joachim, C., & Mboera, L. E. G. (2020). Data quality of the routine health management information system at the primary healthcare facility and district levels in Tanzania. *BMC Medical Informatics and Decision Making*, 20(1), 1–22. https://doi.org/10.1186/s12911-020-01366-w

Ughweroghene, K. O.-E., Ochei, K. C., Oeagu, E. I., Odo, M., & Olubunmi, N.-M. (2017). International Journal of Current Research in Medical Sciences Evaluation of Laboratory Logistics Management Information System in HIV/AIDS Comprehensive Health Facilities in Bayelsa State, Nigeria. *International Journal of Current Research in Medical Sciences*, 3(1), 21–38. http://dx.doi.org/10.22192/ijcrms.2017.03.01.004

USAID. (2020). *Ghana National Supply Chain Assessment: Capability and Performance*. Ghana Health Service/U.S. Agency for International Development. URL: https://ghsupplychain.org/sites/default/files/2023-06/Ghana%20Private%20Sector%20Supply%20Chain%20Assessment%20%282%29.pdf