Ghana Integrated Logistics Management System:
Improving supply chains to bring health for all

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The Vaccine Alliance

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1. Why

Ghana has a high level of immunisations, with 95% of children receiving the first dose of measles vaccine in 2022[1], and over 90% for most other childhood vaccines. Many elements must work together to achieve such results, including a well-functioning supply chain. There are many parts, partners and sub-systems in supplying all the commodities required for immunisation. In 2012 the Ghana Ministry of Health developed the Supply Chain Master Plan[2] which stated that data and information exchange are critical to establishing agile, resilient, and dynamic supply chains.

An important part of realising this plan has been developing the Ghana Integrated Logistics Management Information System (GhiLMIS) to coordinate demand and supply chain processes effectively. GhiLMIS aims to reduce the challenge of a shortage of medical supplies due to delayed approval and procurement processes, and the lack of adequate data on the stock levels of supplies.

Mr Samuel Ampomah, Head of IT at the Ghana Ministry of Health (MOH), said, "When we did our initial systems evaluation, we realized we had over 100 different systems. There was no portability of the data, there was no standardization, there was no visibility which was hampering our efforts." The MOH needed to overcome the multiple separate siloed systems to be able to see what was happening throughout the supply chains for health commodities in real time. Mr. Ampomah further said, "The logistics management information system was designed to help address these challenges. GhiLMIS provides the capability of interfacing with every system which enhances data exchange, standardizing the data to enable real time reporting and access to data that enables us to make informed decisions."

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1 Statista, available here
2 Developing and implementing a sustainable public health Commodity Supply Chain Master plan, Ghana's experience in impacting service delivery, available here

2. What

The GhILMIS electronic platform is a web-based system. It provides end-to-end visibility of all health system supplies, which is not possible to do with paper-based systems. It also automates many transactions and offers analytics across all parts of the supply chain.

The system has many functions including the management of orders for supplies; warehouse management; inventory management; transport management; and financial management. Across the platform, GhiLMIS allows:

- Real-time capturing and processing of all transaction data
- Tracking and tracing of commodities
- Integration and triangulation of data from multiple systems
- Workflow and milestone management processes
- Data analytics and visualization
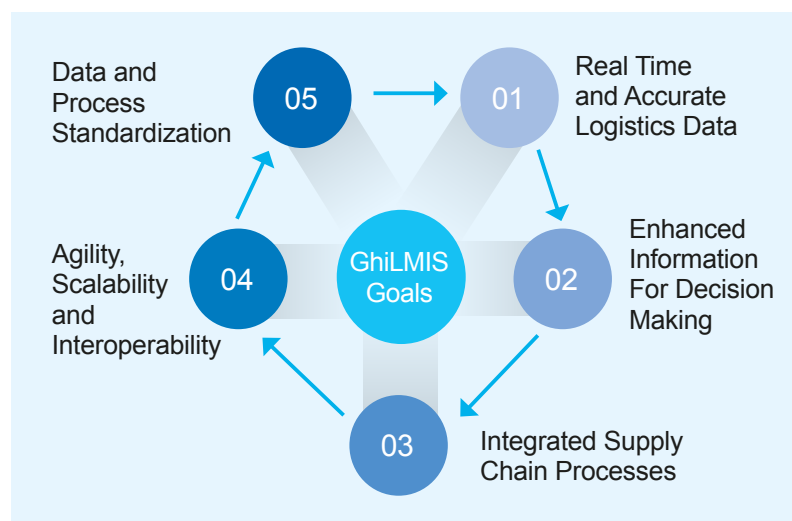
All health facilities, public health commodity warehouses and other nodes in the supply chain need to be computerised for GhiLMIS to function. Laptop computers are provided to facilities that are not computerised, with barcode scanners to accurately record the movement of commodities provided at Central and Regional Medical Stores.

The system can provide business intelligence with prescriptive and predictive analytics. Data from GhiLMIS is exported into the data visualization software Power BI. It is analyzed to predict stock availability based on facility demand trends and indicators such as turnaround time, warehouse processing, and order cycle time. This analysis helps predict system utilization trends and the impact of utilization support interventions.

Whilst GhiLMIS meets the needs of most health programmes, there are some specific requirements of the Expanded Programme for Immunisation (EPI) that have not been deployed yet, such as vaccine vial monitoring (VVM) and temperature monitoring whilst in-transit. Additionally, effective tracking of vaccines costing in the GhiLMIS has not been configured.

3. How

GhiLMIS is owned by the Ghana MOH, with the then Minister of Health, Mr. Kwaku Agyeman-Manu being a great champion. Ghana Health Services use GhiLMIS to manage the supply chain for all commodities throughout the Ghana public health system. The GhiLMIS implementation has been supported by the Global Fund to Fight AIDS, TB and Malaria (GFATM) and USAID.

There was an extensive design phase before implementation, with a detailed requirements specification drawn up with people involved in the health commodity supply chain at all levels of the health system. There were multiple systems providing specific, often fragmented, functionality for the supply chain, but after a detailed analysis, it was found that no existing system could support the end-to-end functionality desired by the MOH. A competitive process was then established to select one system that could meet all of the requirement, and One Network Enterprises (ONE, a US-based company) was selected and has since developed the system together with Ghana-based S4D Consulting using the proprietary One Network software. While there was initially some resistance from implementing partners, once the system was deployed, all stakeholders could see the benefits of GhiLMIS.
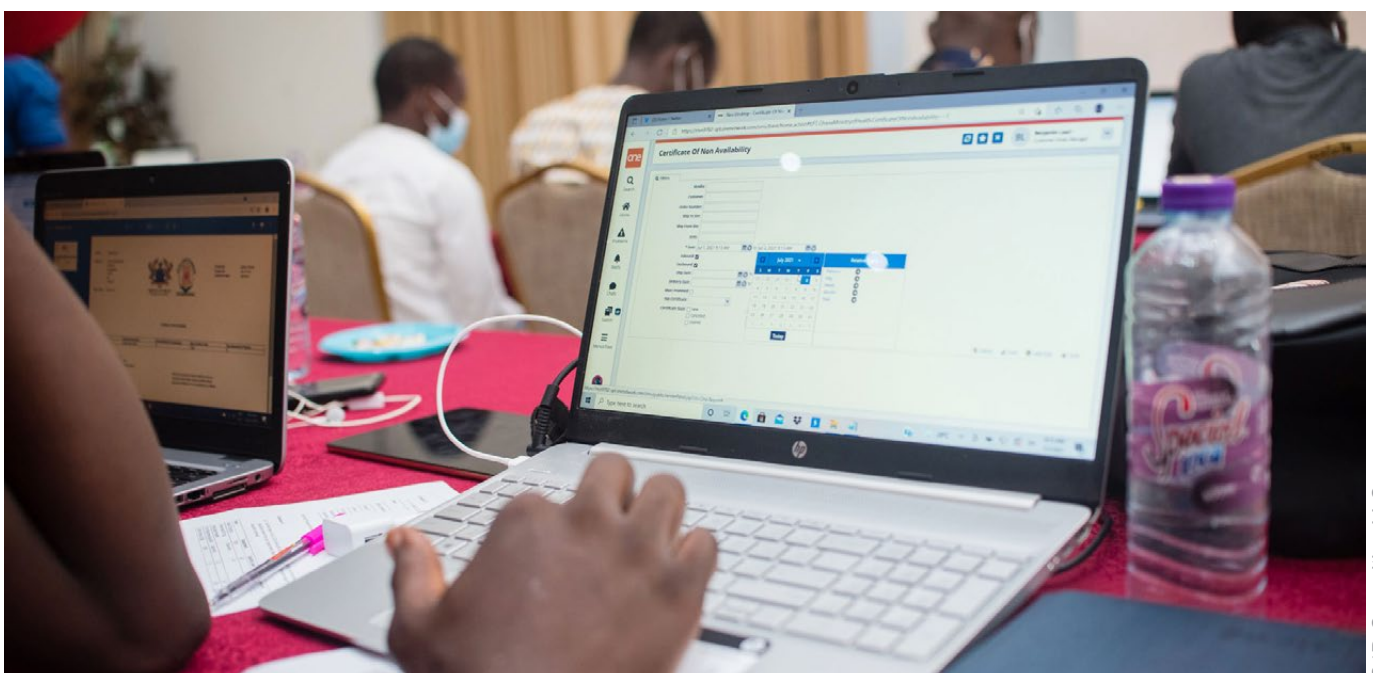

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"GhiLMIS facilitates the availability of real time data and accountability mechanisms; supports informed decision making and reduction of logistics transaction cycle time from one week to one hour, and a reduction of level of effort, optimisation of both capacity management and transportation projected to significantly reduce overall supply chain costs resulting in more effective resource utilisation".

Mr Kwaku Agyeman-Manu, former Minister of Health (2019)

The system was launched just before the Covid-19 pandemic in February 2020. The implementation was done in Tiers, first the Central and regional warehouses and then larger hospitals, and ultimately the Community-based Health Planning and Services (CHPS) centres.

Change management to support the implementation of GhiLMIS has been key. Around 150 'system champions' were identified at the start of the project from all levels of the health system, and these people were consulted to define the requirements of the system, then to conduct testing, training and implementation. They prepared their peers to welcome GhiLMIS and deal with issues before they became problems.

The training was carried out in phases. Initially, 10 people were trained as Master Trainers (Super Users). They were provided with full functional and system administration training along with the necessary skills for adult training. In the second phase, Training of Trainers (ToT) was conducted for over 20 individuals. The 20 ToT trainers then led more than 200 training sessions which were categorized by zones, covering geographical areas. Training was provided at every health facility, and each person had around 1 week of training. Each health site had a process to 'on-board' and then when things were working smoothly it would 'go-live'. The duration of the training varies depending on the level of the site, but it typically takes around 3 to 5 days. Throughout this period, the site's data, including stock data, vendors, and end-user roles and permissions, is onboarded into the system. Once the training is complete, the site's data and end-user information are loaded into the system, and the site can go live. All sites in Ghana where GhiLMIS has been implemented (currently covering 98% of sites nationwide) use the system and have stopped using paper-based methods. Tailored-made training in GhiLMIS has been provided for all national level EPI officers, regional and district EPI Coordinators and cold room Managers across the entire country with support from USAID GHSC-PSM. However, there was a gap in training on GhiLMIS for immunisation staff at the facility level. Some of the trainers weren't familiar with the processes around vaccines, and not enough people were trained in facilities,

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especially with the high churn of staff. In most facilities, the Expanded Programme for Immunisation (EPI) staff dealing with vaccines are not the same as the pharmacy staff using GhiLMIS for other medical commodities.

GhiLMIS was used extensively in the response to Covid-19. The MOH believes that data driven supply chain decision making, enabled by GhiLMIS, allowed the Ghana MOH to effectively manage the disruptions created by the pandemic. It supported the distribution of vaccines to regional and district cold rooms and was central to the vaccination campaign. For example, it was possible to track where specific batches of vaccines had been distributed and if there was an issue with expiry dates, which would not have been possible with a paper-based system.

Most implementation challenges were with the 'last mile', the final step of connecting with the health facilities, especially as internet connectivity was problematic in some facilities. A hands-on approach involving the end-users was essential. The current user support strategy involves regular system monitoring by regional managers followed by the development of action plans for low-performing sites. In some cases, retraining and refresher training is conducted using in-person training and eLearning, and S4D set up a chatbot that leverages generative AI to address end-user questions and ongoing support.

As of March 2024, all hospitals, polyclinics and health centres nationally, and CHPS centers from 15 of 16 regions are using GhiLMIS. The remaining CHPSs will be using the system by mid-2024. Consistently since going live in 2019, all regional medical stores have utilized GhiLMIS monthly. In February 2024, 89% of onboarded hospitals, 81% of health centers, and 64% of CHPS utilized GhiLMIS for various supply chain functions. While the system has largely focused on the public sector, some private hospitals also use GhiLMIS.

4. Results

GhiLMIS has:

1. Improved planning and decision making to address the country's Covid-19 needs and address pandemic disruptions to the entire supply chain;

2. Allowed better execution of supply and demand planning utilizing intelligent demand and replenishment sensing engines. The system can predict the demand that a facility will require during the order period based on inventory levels and average monthly consumption;

3. Built a supply chain that is agile and responsive to disruptions; and

4. Provided a business intelligence engine that provides prescriptive and predictive analytics to different scenarios.

Dr Catherine Armah, the head of Logistics Management Unit (LMU) at Ghana Health Services, has seen GhiLMIS provide end-to-end near real time data which has made the health supply chain much more efficient. According to her, GhiLMIS has led to improved last-mile distribution and more orders being fulfilled on time. People involved with the service say that the availability of commodities has improved, there is less wastage due to expiry dates being passed and stock outs throughout the Ghanaian public health system have been reduced, though there has not been a formal evaluation to determine this. Interviewees felt that GhiLMIS had led to a reduction in loss and theft of commodities. GhiLMIS has reduced the time for making data available from 3 months to around 1 day. The order processing cycle time has fallen from 1 week to 2 days.

Bernard Asamany, Deputy Director of Supplies, Stores and Drugs Management (SSDM) Division at the Ghana Health Services said "Today, real time logistics and transactional data is generated by the click of the button addressing operational inefficiencies that existed prior to the system implementation".

Currently, whilst the requirements of EPI were gathered and configured in GhiLMIS, gaps exist so that GhiLMIS doesn't meet all the needs of the EPI programme. The Ghana EPI unit is supportive of GhiLMIS and sees that it can offer great benefit to vaccination commodities management, especially as it is impossible to get real-time information from the other systems used, the Stock Management Tool (SMT) and ledgers.

Enablers, barriers and lessons

Enablers of the success of GhiLMIS have been:

- The drive and support of the Minister of Health.

- Broad stakeholder commitment and buy-in from the start, following extensive consultation and involving partners in requirements specification and design of the system.

- The agreed national master plan.

- Laptop computers provided with training which enabled the system to work and meant the staff were largely positive about the programme.

- Funding from GFATM.

Things that could have been done differently:

- There could have been more piloting of GhiLMIS between different tiers of facilities before the wider rollout cascade. Internet and infrastructure at the central urban areas is generally good, whereas at less resourced facilities, the internet and technical skills are more of a challenge.

- Initial training was not sufficient. There is a need for continuous capacity building, not just a once-off training course, especially as there is high attrition amongst health workers.

- Involvement of immunisation data management team/ experts during training to bring on-board immunisation context on the use of the tool.

- Ensuring that vaccine managers at the facility level are trained on the use of the platform

Lessons learned:

- Establish and follow clear governance processes.

- Active championing by the Minister drives progress.

- Involve users and other stakeholders at all levels in the design, testing, training & implementation.

- System interoperability should be addressed from the start.

"GhiLMIS' unique implementation approach,
which included a predefined implementation journey,
stakeholder mapping, end-user design, and patient-centric
focus, allowed for quick acceptance and agility in dealing
with disruptions such as Covid-19."
Mr. Philip Lule, S4D Consulting

5. So what

While GhiLMIS is currently functioning well nationally, new features are planned to continually improve the system. This includes plans to develop a version of GhiLMIS for a basic phone for sites with poor connectivity, creation of enhanced reporting and analytics with dashboards and clearer data governance to dictate who can use what data for what purpose. Also, GhiLMIS will be integrated with the DHIS2 and a Hospital Management system, the Lightwave Health Management Information System (LHMIS). Both of these will go live by the end of 2024. Finally, to improve capacity, a regional support system for GhiLMIS utilization will be made operational for each region of the country.

With a little added functionality GhiLMIS can be improved to make it more appropriate for vaccination, and then all vaccine commodities can go through the system. This would greatly help routine vaccination efforts, which would be strengthened by further training of EPI staff at all health system levels. The EPI unit is eager to connect GhiLMIS with the DHIS data to monitor vaccines used in regard to coverage and wastage, to identify where there is high or low wastage and where patients may be missed.

Ghana has demonstrated that a modern digital supply chain system can be implemented at national scale within a few years. While there has not been a formal evaluation, all involved in the programme are clear that GhiLMIS has greatly improved the supply chain, reducing stockouts and wastage, making orders much quicker and providing data for analytics and improved decision making that would be impossible without digital systems.

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