TECHNICAL BRIEF

SEEING THROUGH THE CLOUD
Achieving end-to-end data visibility using cloud-based technology

BACKGROUND

District and provincial managers learn how to use the SIGLUS web portal with limited resources.

Key to delivering high-quality health services to patients are accurate data on health commodities on hand and in the pipeline to service programs. Robust systems that can track stock at multiple levels and generate timely and actionable reports for stakeholders are essential to ensuring patients receive the best possible care.

In Mozambique, nearly all residents seek treatment and medication at one of nearly 1,600 public health facilities. These are usually small clinics with limited staff. In these "unidades sanitarias," frontline health workers not only conduct checkups and fill prescriptions, but also track and maintain stocks of medicines.

These local health facilities found in both rural and urban areas are part of four levels that make up Mozambique's health supply chain serving more than 29 million people. The levels are:

- 6 regional warehouses
- 11 provincial warehouses and 1 intermediary warehouse
- 143 district warehouses
- 1,580 local health facilities "unidades sanitarias"

Local health facilities at the lowest level of the public health system make up 98 percent of the supply chain. Historically, only the warehouses at the first three levels used electronic information systems, while the local health facilities used a paper-based system to catalog stocks and request new supplies.

CHALLENGES

Adequately managing data for a supply chain serving so many patients across a large geographic area requires a robust system to gather, aggregate, and analyze information. Unfortunately, 98 percent of the public health supply chain in Mozambique was relying on a slow and inefficient paper-based system to collect and report data, creating forecasting and supply planning challenges at the central level.

> With the paper-based system "statistical data was dependent on availability of transport and personnel to collect requisitions at the health facilities."
>
> *Vladimiro Matimbe*
> *District Warehouse Manager*

Overstretched health workers were often responsible for inventory management and reporting through the paper-based system in addition to their primary duty to treat patients. These dual responsibilities led to challenges that have rippled through the supply chain:
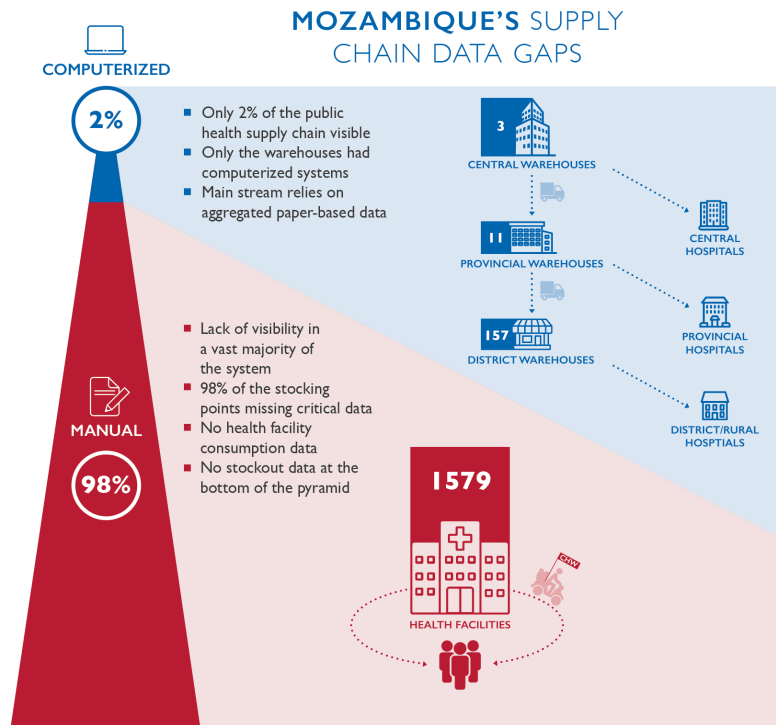
1. A large time burden placed on the health care workers and pharmacists using the paper-based system, reducing the time spent caring for patients
2. Calculation errors in health supply orders
3. Lack of last-mile consumption data for decision makers at the district, provincial, and national levels
4. Lack of last-mile consumption data for decision makers

Supply chain managers and analysts at the national, regional, and local levels use health facility reports to forecast, budget, order, and distribute commodities. Poor data quality can often lead to inaccurate ordering, which in turn causes overstocks, understocks, stockouts, and wastage at the facility level.

METHODOLOGY

Mozambique's Ministry of Health recognized the need for a solution to address the data visibility and accuracy challenges of the paper-based system. In its 2014 national pharmaceutical logistics strategic plan the Ministry of Health identified implementing an electronic logistics management information system (eLMIS) in local health facilities as the solution to allow for faster, automated reporting and easier data management at all levels.

MOZAMBIQUE'S SUPPLY CHAIN DATA GAPS

COMPUTERIZED

2%

- Only 2% of the public health supply chain visible
- Only the warehouses had computerized systems
- Main stream relies on aggregated paper-based data

MANUAL

98%

- Lack of visibility in a vast majority of the system
- 98% of the stocking points missing critical data
- No health facility consumption data
- No stockout data at the bottom of the pyramid

3 CENTRAL WAREHOUSES

11 PROVINCIAL WAREHOUSES

157 DISTRICT WAREHOUSES

CENTRAL HOSPITALS

PROVINCIAL HOSPITALS

DISTRICT/RURAL HOSPITALS

1579 HEALTH FACILITIES

The criteria for the software included the following features and requirements:

- Availability of consumption data
- Compatibility with health facility procedures for management of medicines
- Interoperability with existing systems
- Online and offline modes
- Real-time transactions
- Guarantee of support, maintenance, and sustainability

SOLUTION

Beginning in 2015 and stretching into the following year, six different software platforms were considered and used in pilot tests. The Clinton Health Access Initiative (CHAI) partnered with the Mozambique Ministry of Health's central medical store (CMAM) to pilot the Electronic Stock Management System (ESMS), which used the open-source software OpenLMIS. The pilot initially allowed health workers at nine health facilities to use Android tablet computers and 2G internet from local cellular phone service providers to receive stock-level alerts and make commodity requisitions. After a one-year pilot test, stakeholders selected this program for national-level rollout across the public health system in November 2016.

In 2017, the pilot program's support transitioned from CHAI to the USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project. As part of the transition, CMAM officially adopted the system as the only eLMIS to be rolled out to all health facilities in the country and

renamed the program the Sistema de Informação para Gestão Logística nas Unidades Sanitárias (Logistics Management and Information System for Health Facilities). Most commonly known by its Portuguese acronym, SIGLUS, the software automated much of the inventory tracking, calculations, cataloging, and requisitions and electronically mimicked and automated the former paper-based system.

> **"SIGLUS** facilitates the requisition process. Since it automatically inputs all data and automatic calculation is used in quantification, it helps in sending timely requisitions."
>
> *Clésio Johane*
> *Health Facility Technician*

SIGLUS shifted the burden of those tasks away from pharmacists and health workers to a software platform specifically designed to reduce human error, address any gaps left by the paper-based system; allow for real-time visibility into stock levels, consumption; and needs, and ultimately, better ensure a reliable, continuous supply of lifesaving health commodities.

With GHSC-PSM support, the pilot program transformed into a full, large-scale rollout, expanding from nine facilities at the end of 2016 to over 996 facilities (63 percent) by September 2019. In a little more than two years, hundreds of technicians, managers, and facility workers received training on SIGLUS software. Following the successful pilot, the Ministry of Health integrated SIGLUS into the national supply chain at the provincial, district and community levels, filling a huge data gap in the supply chain and providing new visibility into the facility level.

WHAT SIGLUS DOES

SIGLUS can:
– Automatically calculate requisitions
– Issue alerts for low stock levels, risks for overstocking/understocking, and upcoming expiries

SIGLUS captures data for:
– Stock on hand
– Quantities issued, received, requested and adjustments

SIGLUS covers all commodities in the Mozambique health supply chain including:
– Antiretrovirals
– Antimalarials
– Contraceptives
– Rapid diagnostic tests
– Antibiotics
– Essential medicines

The cloud-based application tracks inventory and consumption of all commodities stored at health facilities and captures data including stock on hand; quantities issued, received and requested; patient ARV regimens; and requisition orders.

SIGLUS is comprised of two main components: a tablet used by frontline health workers and the portal accessed through a computer at the district, province, and CMAM level.

Frontline health workers in the unidades sanitarias upload data via mobile networks through a custom-made app on Android tablets. Then, managers at district and central levels access this data and track information via a cloud-based web portal where all usage and facility data are stored. CMAM can access critical consumption and stock data in real time to inform distribution activities, strategic decision making, forecasting and supply planning.
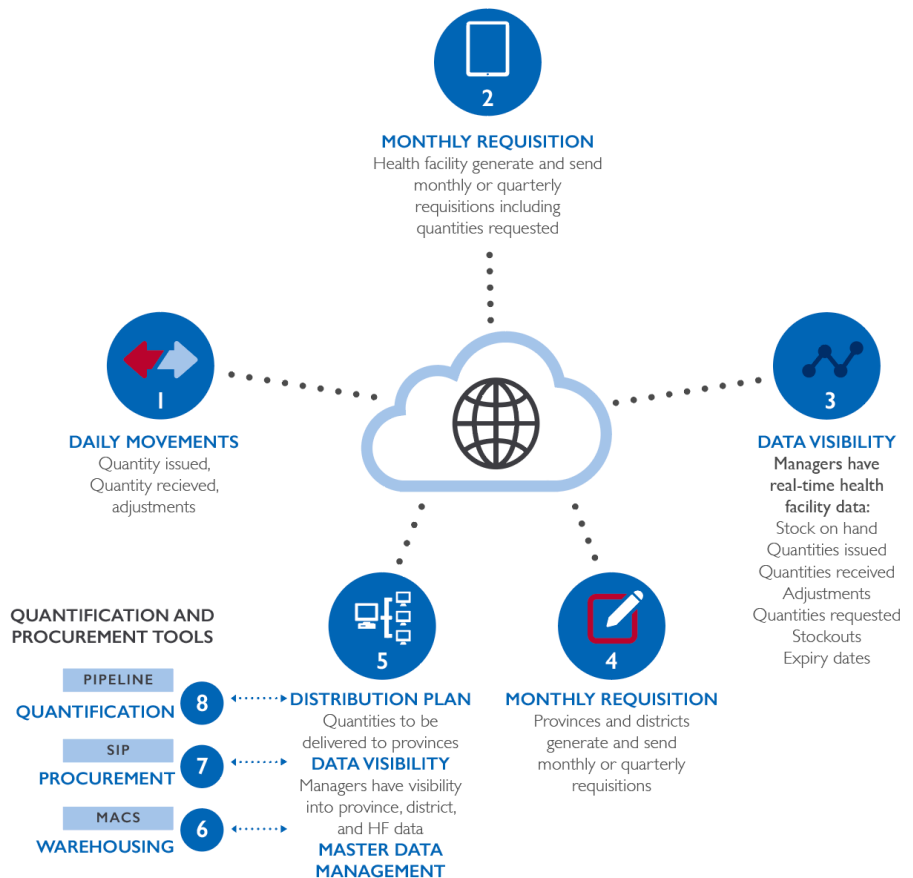SIGLUS features include:

- Electronic inventory management and live data capture at health facilities
- Electronic requisitions of new stock
- Automatic calculations of requisitions, including suggestions for order quantities
- Automated alerts for impending stock expiration, stockouts or overstocks
- Automatic alerts for overstocks, expiring products, low stock and stockouts

The SIGLUS web portal, based on OpenLMIS source code, is also interoperable with other health-related systems such as the District Health Information System (DHIS2), which is currently used in 47 countries, including Mozambique, and the Open

HOW SIGLUS WORKS

– Frontline health workers upload data to SIGLUS via mobile networks through a custom-made app on Android tablets
– Managers at district and central levels track the information in SIGLUS
– CMAM officials access consumption and stock data in real time to inform distribution, forecasting and supply planning, and other strategic decisions

MOBILE SOLUTION FOR END-TO-END VISIBILITY

2

MONTHLY REQUISITION
Health facility generate and send monthly or quarterly requisitions including quantities requested

1

DAILY MOVEMENTS
Quantity issued, Quantity recieved, adjustments

3

DATA VISIBILITY
Managers have real-time health facility data:
Stock on hand
Quantities issued
Quantities received
Adjustments
Quantities requested
Stockouts
Expiry dates

QUANTIFICATION AND PROCUREMENT TOOLS

PIPELINE
QUANTIFICATION **8**

SIP
PROCUREMENT **7**

MACS
WAREHOUSING **6**

5

DISTRIBUTION PLAN
Quantities to be delivered to provinces
DATA VISIBILITY
Managers have visibility into province, district, and HF data
MASTER DATA MANAGEMENT

4

MONTHLY REQUISITION
Provinces and districts generate and send monthly or quarterly requisitions

REPORTS GENERATED THROUGH SIGLUS CAN:

– Provide real-time information on stock on hand, consumption, loss and adjustments, stockout and submitted requisitions
– Visualize facility-level reports and aggregate information for the different levels (i.e., district, province and national)
– Export data into Excel for further analysis
– Generate customized reports that include weekly information on supply on hand and the status of products at health facilities

RAPID SCALE-UP
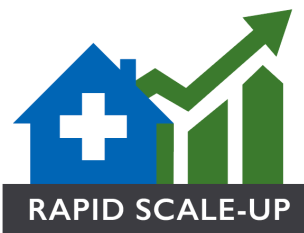
In 2016 SIGLUS was used in

9

health facilities.

By September 2019, SIGLUS was operational in more that 63% (996) of Mozambique's health facilities with plans to reach more than 1,500 by the end of 2020.

Medical Record System (OpenMRS).
Facility staff can use SIGLUS for all product categories in the supply chain and can add and track new products in the application, allowing them to manage requisitions much more efficiently.

ADDRESSING LOGISTICS ELEMENTS AT THE OUTSET FOR SUCCESSFUL IMPLEMENTATION

With nearly 1,600 government-sponsored health facilities throughout Mozambique, ranging from central hospitals to community-level clinics, the primary challenges of scaling up SIGLUS were mainly logistical: to distribute the required hardware (Android-based tablets), train facility staff in how to use the app, and then ensure continued use of the software after training.

Hands-on training
To meet these challenges, GHSC-PSM fielded a team that

traveled to key points across Mozambique. While in the provinces, the team assembled key facility staff, distributed tablets with SIGLUS preinstalled, and hosted dozens of trainings for hundreds of facility staff. This operation has been ongoing since the beginning of 2017. By September 2019, GHSC-PSM had trained staff and begun operations at more than 900 health facilities (about 63 percent) with plans to roll out SIGLUS to more than 1,500 by the end of 2020. This scale-up is ahead of schedule, as the Ministry of Health requested the application be in use in 30 percent of health facilities by 2020 (roughly 465 facilities).

Connectivity
In addition to hands-on training, the project needed to account for connectivity issues in Mozambique. While mobile data coverage is generally widespread, connectivity can be limited in rural areas. The project analyzed cell phone coverage in the country to know which providers are strongest in certain regions and planned accordingly when distributing tablets

CHALLENGES ADDRESSED:	CENTRAL-LEVEL BENEFIT	FACILITY-LEVEL BENEFIT
Timeliness of Facility-level Requisitions	From April to June 2019, 75% of service delivery points sent requisitions trough SIGLUS, from which 65% were sent on time, allowing central-level planners to better manage forecasts for procurements and manage provincial-level stock distributions.	Creates a more efficient requisition system for facilities, allowing for a more reliable flow of commodities to facilities, helping to ensure patients receive critical services and medicines.
Calculation Errors in Supply Orders	Automated calculations allow central and provincial-level distribution centers to send the correct amounts of stock to facilities, enhancing stock management throughout the supply chain.	Reduces the burden on facility staff to manually calculate requisition orders, increases accuracy and efficiency, and allows staff to focus on patients rather than stock and order management.
Late or Nonexistent Submission of Consumption and Stockout Data	Automated data reporting to the central level ensures that previously inaccessible data can now be used for forecasting and supply planning purposes, allowing for enhanced and more detailed planning throughout the supply chain.	Reduces the burden on facility staff who previously managed stock consumption and reporting through a manual paper-based system, allowing staff to focus on patient services.
Lack of Last Mile Consumption Data for Decision Makers	The automated information flow through SIGLUS increases data visibility at the health facility level, providing central-level planners relevant data for strategic decision making.	Facility-based staff receive the benefit of improved central-level supply chain management, with reliable shipments of supplies to facilities.

equipped with SIM cards to ensure the best possible connectivity. A key feature of the SIGLUS Android app is its ability to collect data offline and then upload to the cloud once connectivity is restored.

Additionally, solar panels were installed by the project at the health facility level ensuring a continuous source of electricity for tablet recharging and use.

OVERCOMING CHALLENGES WITH SIGLUS

The SIGLUS implementation took the responsibility of calculations and inventory out of the hands of health workers, who had used a paper-based system, and moved the enterprise to a cloud-based software platform. The software improved the frontline health workers' ability to upload and report information that reflected their real-time needs.

LESSONS LEARNED

By September 2019, SIGLUS was scaled up to more than 900 health facilities in Mozambique and is on track to expand to over 1,500 by the end of 2020. Below are some key lessons learned from the development and implementation of SIGLUS.

> "Now I have visibility of the exact status of the medicines at the health facilities. It helps me supervise and support the district managers."
>
> *Milva Penes*
> *Gaza Province Warehouse Manager*

Ensure system works on a small scale first. The success of the SIGLUS rollout to date can be attributed to starting small. Developers focused on a controlled expansion, stabilizing and refining the system, and seeing how it behaved in different regions and provinces within the country. System progress and use was closely monitored by GHSC-PSM's information systems team in Maputo, who then worked with the vendor to build new features, fix bugs, implement updates, and address deficiencies as needed. Once the system, people, and processes proved effective on a small scale, CMAM worked with GHSC-PSM to prepare for a massive expansion of SIGLUS utilization in Mozambique.

Address change management needs. Work with local government and health providers to seamlessly move from a paper- and call-based management system to an electronic reporting system through regular and frequent feedback and if needed, visits to provinces, districts and health facilities were critical to rollout success, ensuring constant visibility and promotion of the software. This engagement also represents an opportunity to communicate with operational and support staff onsite to troubleshoot any issues and discuss additional support needs.

Manage expectations to allow the system to mature.
During implementation and early phases, manage expectations to create an enabling environment for useful results. Bugs, edits, and additional features are all a natural element of working with a new system that goes online. Time and effort are needed to achieve reliable and accurate data useful to central-level planners. Immediate expectations for meaningful data that can be used for planning and procurement purposes must be tempered.

In 2016, SIGLUS did not have the full suite of features it has today. The development process has been continuous, and improvements made based on end user feedback, bug reports, and Ministry requests. People often underestimate the time it takes to develop and roll out a software system. With SIGLUS designed for use at over 1,500 sites, a carefully designed and phased approach was required, one that balanced utilization in the field and continuous development of the Android app and web portal.

Collaborate for expansion and product improvement. A public-private sector agreement between CMAM and mobile providers secured a service package that met SIGLUS' technical needs while ensuring sustainable use of the mobile network. This allowed health workers uninterrupted service to the app for consistent data input.

At the same time, collaboration among implementing partners facilitated the expansion of SIGLUS from 157 health facilities at the beginning of 2018 to 895 by December 2018. Every implementing partner could provide support from equipment to training and monitoring of the system.

Prioritize training and support. Training end users is a top priority as the system's success depends on users using the features of the software to their fullest potential and enabling relevant and meaningful data collection. In the rollout, GHSC-PSM held multiday trainings at regional points where staff from multiple facilities attended. Beyond simply teaching utilization, creating a culture of support and staff investment in SIGLUS was critical, as meaningful training produces meaningful data. Demonstrating buy-in from central- and provincial-level health officials, as well as the system's potential to ease facility staff and pharmacist workload, contributed greatly to SIGLUS adoption.

Replicable for use in other countries. OpenLMIS' open-source software is replicable and modifiable in other countries and capable of meeting unique health data logistics management needs while offering a sustainable solution. Removing the burden placed on health care workers and pharmacists also enables more time for patient care. This is just the beginning of implementing this technology, not only in Mozambique, but also in other countries including Angola and Malawi. GHSC-PSM has a long-term objective of fostering cross-pollination and collaboration between supported countries that require collecting facility-level data and improving supply chain activities through an advanced eLMIS.