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DIGITALIZING INVENTORY MANAGEMENT IN RESOURCE-CONSTRAINED HEALTH FACILITIES

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Digitalizing Inventory Management in Resource-Constrained Health Facilities

Does it improve medicine management at lower level facilities?

The gains to be realized from the digitalization of stock management at health facilities, like improved visibility across all levels, are widely recognized. However, most of Uganda's Health Centre IIs and IIIs lack adequate infrastructure to support digitalization.

The S+ solution is an innovative solar-powered digital solution for stock management developed through a partnership with UNCDF, Medical Access Uganda Limited (MAUL), and Signalytic to improve access to essential medicines and promote equity and quality of health services in lower-level health facilities.

Background

Since 2010, Uganda's Ministry of Health (MOH) has been implementing a Primary Health Care (PHC) policy that involves the procurement, supply and distribution of Essential Medicines and Health Supplies (EMHS) using a dual pull-push system, after more than eight years of considerable investment in and experimentation with a pull system. The pull system was maintained for Health Centre (HC) IVs and Hospitals, while the push system was adopted for rural and hard-to-reach lower-level health facilities— including HC III and HC II. This is intended to reduce delays in requisition and procurement of EMHS, minimize risks of corruption in medicines procurement, and address chronic drug stock-outs at the primary care levels—HC IIs and HCIIIs. It was also intended to reduce the burden on frontline health workers associated with the requisition of medicines and other health supplies.

Recent efforts by the MOH, donor agencies, and other stakeholders within the health eco-system have enabled better stock and inventory management and reporting. The introduction of RxSolution at higher-level facilities (Regional & National Referral Hospitals) has improved stock and inventory management aspects, especially concerning data quality. However, most of this information largely remains siloed at health facilities, embedded within electronic Logistics Management Information Systems.

Whilst largely neglected, lower-level health facilities (HC IIs and IIIs) account for a large percentage of the Out-Patient Department (OPD) visits and demand for EMHS in Uganda. Despite this, lower-level health facilities continue to utilize manual stock and inventory management systems that are paper-based and prone to human error, and depend on reports that are deficient of effective data quality checks, auditing, and information vital to support stock and inventory management functions.

UNCDF has partnered with MAUL & Signalytic to address the challenges in determining and maintaining adequate stock levels in lower-level health facilities such as frequent occurrences of over-or under-stocking and stock-outs through development and deployment of a digital tool – S+ solution starting with Kiryandongo district.

The digital tool will be useful to health facilities and all entities like MOH, international agencies, warehouses, private entities, and decision-makers within the sector, not just by improving connectivity but also by facilitating market linkages, research, and development, among other advantages.

The S+ solution aims to provide the following benefits:

- Improved commodity management, i.e., reduction in pilferage and expiries
- Increased stock accuracy
- Improved commodity traceability
- Improved tracking of EMHS in facilities and communities
- Digitalization and computerization of existing commodity and supply chain management processes, including existing HMIS tools
- Increased reporting data quality (availability, timeliness, accuracy, validity, and completeness)
- Real-time data visibility across the health structure

Digitalizing Health Inventory Management

Access to real-time stock status data is vital in achieving improved and harmonized health system support, especially within the health supply chain. This is critical for health system strengthening since it can generate timely information to support proper planning, monitoring and evaluation, and forecasting at all levels of the health system.

The majority of HC IIs and IIIs use a paper-based inventory management system due to the lack of the needed digital infrastructure. Primarily, stock status reporting is done routinely through the district biostatisticians, who update DHIS-2 for health facilities under their jurisdiction. SMS-based reporting is most prevalent at HC IIs and IIIs through tools like RASS and mTRAC. Nonetheless, the health sector continues to suffer stock-outs and non-availability of EMHS. This is partly due to the lack of visibility and continued use of manual stock management and monitoring systems.

Many stock management tools have been built to require a commuter workstation or smartphone, a reliable energy source that can adequately power the hardware when needed and adequate and reliable network services to connect the data to a cloud-based database.

To achieve the intended use for these tools, there must be a confluence of independent technologies and inputs, such as hardware, power, connectivity, and software. All of these have different providers with varying degrees of availability in different geographies, operational costs and operational limitations.

Market constraints being addressed by the S+ digital tool

As seen from above, several potential points of failure can prevent a digital tool from achieving its desired function. Below are some of the market constraints that this project is unlocking by leveraging digital technology.

- Poor network connectivity in rural areas
- Limited access to power
- Lack of visibility into facility inventory at lower levels – HC IIs & III
- Stock out of reporting tools
- Weak inventory management practices
- High costs of internet

How the S+ digital tool works

The S+ platform is the digital health backbone of the future. By leveraging internet & smartphone penetration in rural Uganda, the solution addresses the most prevalent challenges to digitalization in the health sector—hardware, cost, connectivity, and power.

The core product is a solar-powered box deployed in any facility. It can locally run all desired digital solutions (e.g., LMIS and EMRs). It runs on a unique type of blockchain technology to protect data and communicate with other health facilities regardless of internet availability. The

boxes and terminals communicate how they are doing and when they need assistance before a problem occurs. Connectivity and power are integrated from the beginning, ensuring the flawless functioning of the system wherever it is deployed.

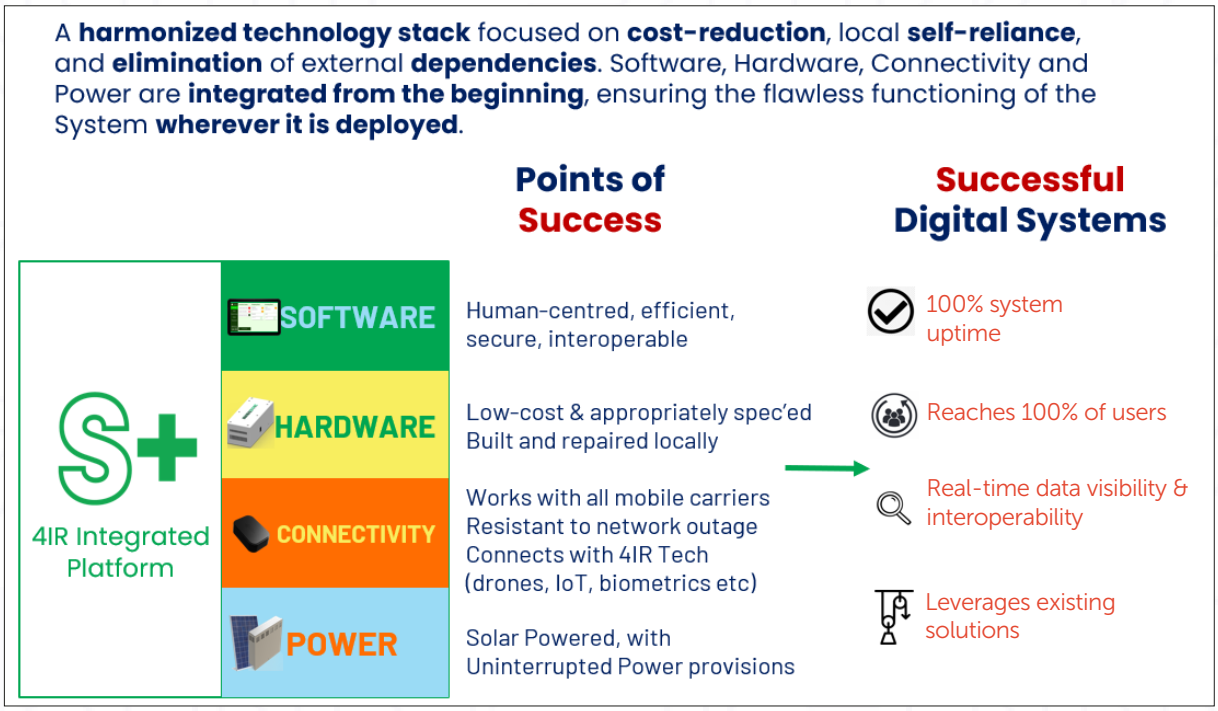


Figure 1 Advantages of the S+ Platform

High-quality, real-time data collected on the platform can be accessed by stakeholders through the software and systems they already use. The S+ platform is connected by a common database (S+ DLT), which is able to store information from many different sources. Through the platform, users are able to access pre-approved mobile applications and websites. The platform is also able to connect and store data for Internet-enabled devices such as temperature sensors, drones, and medical devices, as well as other actors in the sector such as Village Health Teams and pharmacies. All data can then be communicated to any 3rd-party database in the country through Signalytic Data Bridges.

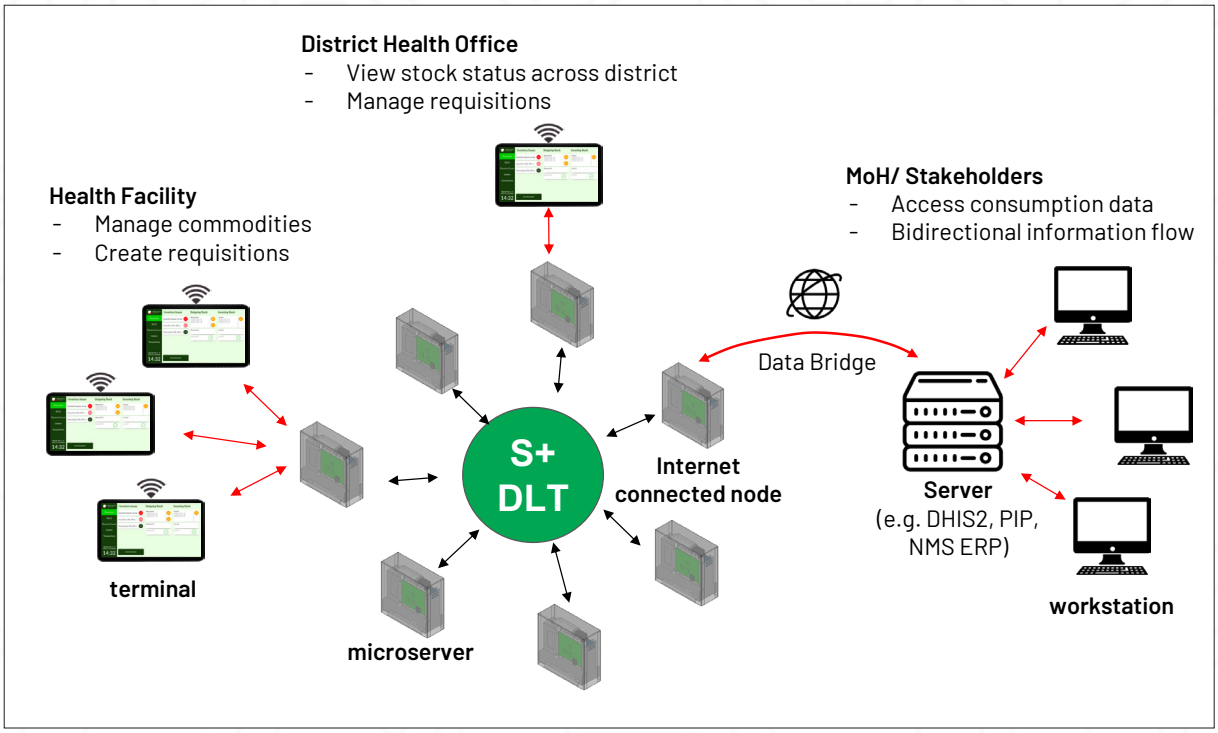


Figure 2 S+ System Architecture

- How can technology be used to improve inventory management in resource constrained settings?
- How can we ensure digital innovations in health are inclusive and impactful?

1. Building Buy-in

The project teams devoted time to showcasing the benefits of implementing a digital stock management application at lower-level facilities. The focus was on change management and securing buy-in from strategic partners at the Ministry of Health Division of Health Information (MoH DHI), Kiryandongo district leadership, health facilities' leadership, and users of the solution.

Leadership buy-in

It was pivotal to show the key stakeholders the digital solution, key project milestones and their role in fostering sustainability in project implementation.

Engagements with health facilities

To ensure buy-in from the health facilities, several engagements were held with facility leadership and store managers, focusing on highlighting the benefits of the system in inventory management and system training of end-users.

User requirements, system specification and product development

Getting user feedback during the development of the digital tool was very important for the project teams to ensure that the final product was built with input from the final users – store managers at the health facility. Eight sessions on user acceptance testing were conducted with different store managers from HC IIs and III.

2. Facility onboarding

The project team used a holistic approach to sensitize health facility and district staff about the value of the S+ digital solution. This promotes increased system adoption and decreased chances of failure. Below is the facility onboarding process:

- The team conducted meeting sessions with the district leadership (RDC, DHO, CAO, Biostat) to present the system, its benefits, and the value proposition.
- The team conducted engagement meetings with the health facility leadership with the aim of getting system buy-in.
- The team signed system MOUs with health facility leadership. This helped outline the roles of project implementing partners and health facilities concerning the use and management of the hardware deployed at the sites.
- The technical team created the user accounts for store managers and the health facility incharges on the S+ solution mobile application and shared the user credentials with the stakeholders.
- The project team conducted user training of the stock management application for store managers and incharges at the health facilities. Superusers were identified and trained as Trainer of Trainers (ToT) to champion system use and offer training to less skilled staff on using the digital solution, thus promoting sustainable use of the system.

Using a ToT approach adopted in 2017 by the MoH and development partners, ToTs were selected at the facility level and trained on usage and basic troubleshooting of the solution. Site-based training was carried out during the rollout at the health facility, where system benefits were showcased to facility management and staff. This was aimed at getting system buy-in at all levels of the supply chain.

A total of 14 health facilities (nine HC IIs and five HC IIIs) and one district store were analyzed for connectivity and stock data synchronization to the digital ledger network as of September 2021. A summary of select pilot results are indicated in the following table.

	# Connected	# Not Connected
HC IIs	7	2
HC IIIs	4	1
District Store	1	0
# HFs Connected	**12**	**3**

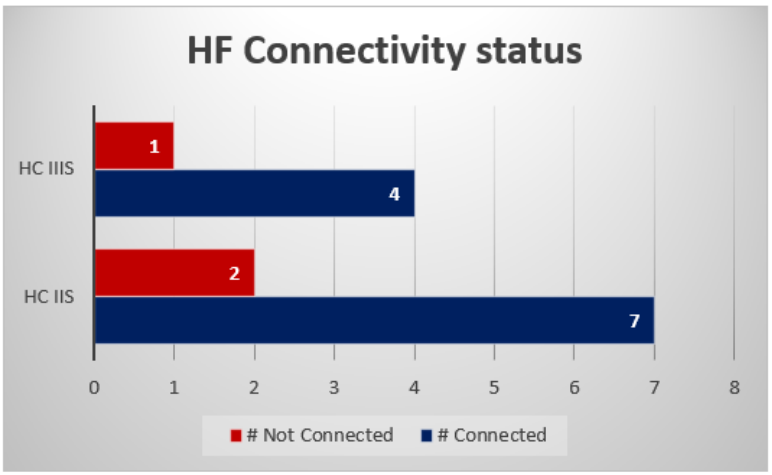
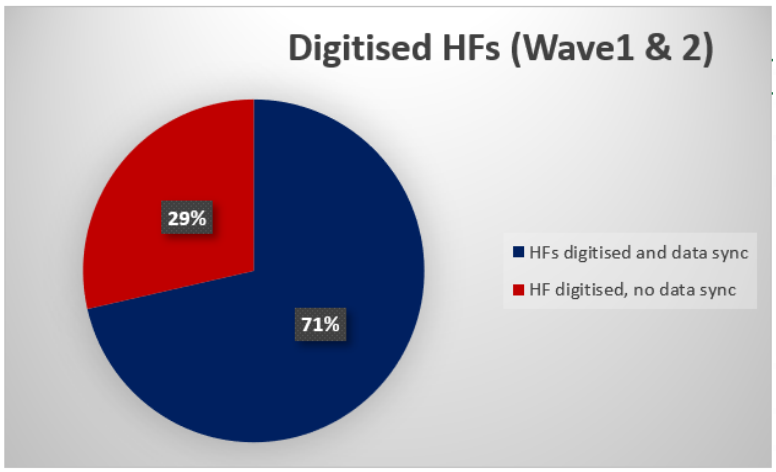


Figure 3 Health Facility Connectivity Status

Connectivity to the central network statistics for September, lot 1 and 2 health facilities to which pilot deployment was completed.



HFs digitised and data sync	10
HF digitised, no data sync	4
	14

Figure 4 Digitalized Health Facilities

Inventory digitalized health facility statistics as of September, lot 1 and 2 health facilities to which pilot deployment was completed.

3. Continued facility performance monitoring, system updates and support

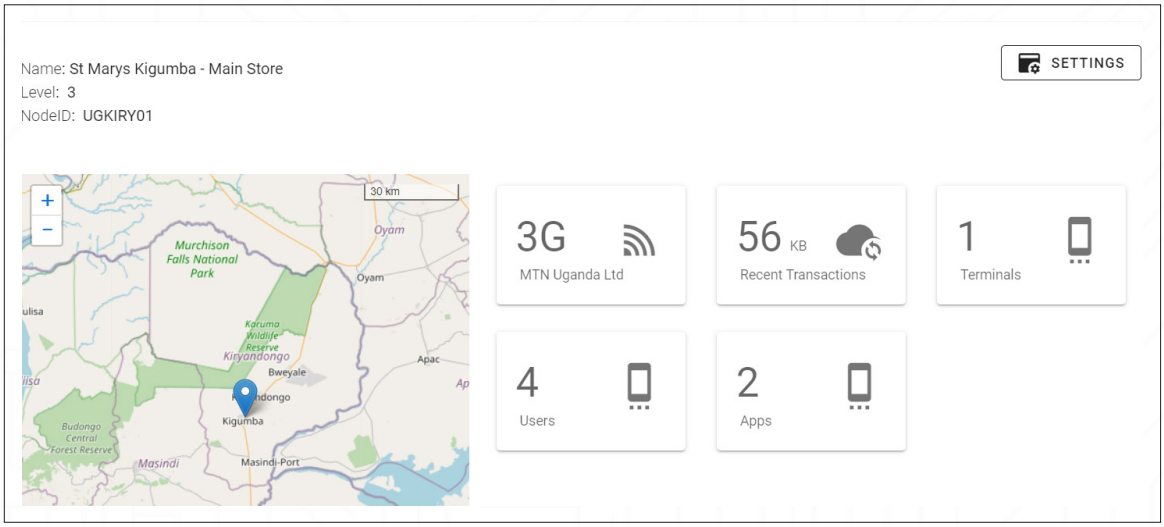


Figure 5 S+ Administrative Dashboard

The S+ solution has a web administrative dashboard that helps to monitor connectivity, battery performance, usage and transaction history from all connected health facilities. This acts as the first line of diagnostics to the team providing support to facilities experiencing challenges. The dashboard also offers comprehensive transaction logs critical to system debugging and support.

The solution is currently on V74, a result of cumulative updates/application iterations overtime stemming from multiuser interactions in the user acceptance testing phase to user feedback from store managers, facility incharges and district personnel in the pilot deployment phase. The feedback generated is pivotal to making improvements on the application, thereby helping to foster user adoption.

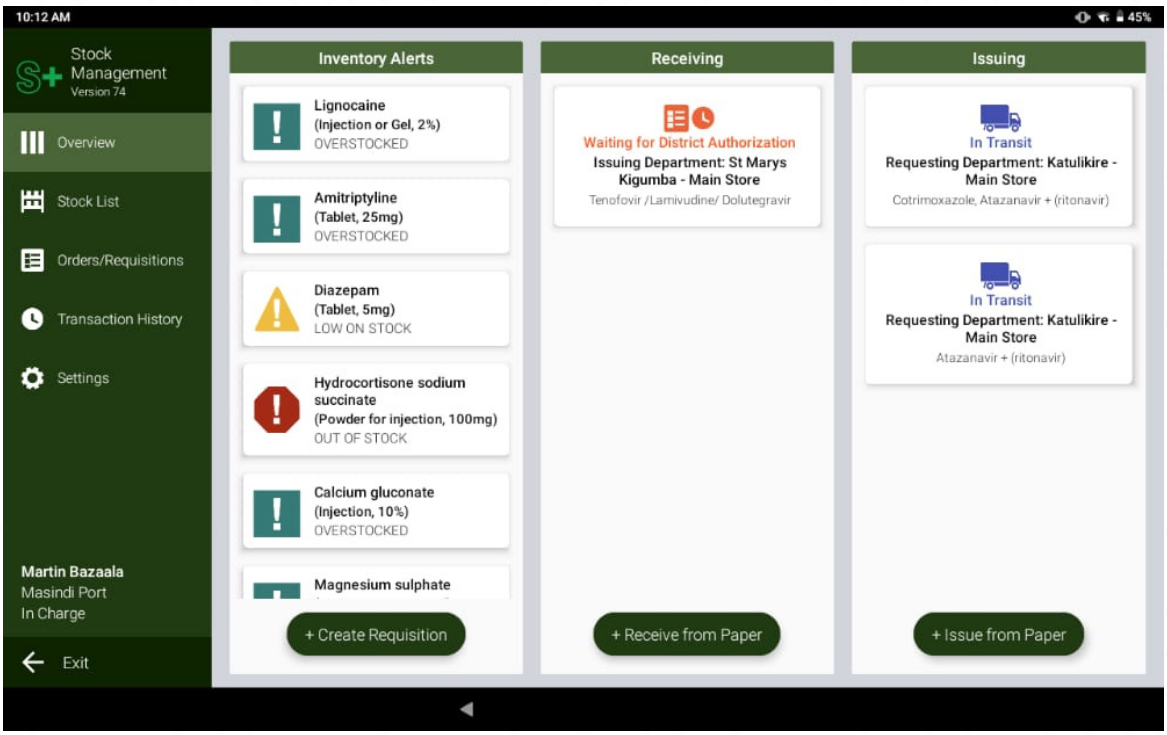


Figure 6 Stock Management Application Interface

4. Stakeholder engagement

Ministry of Health

The project team made a presentation to the DHI sub-committee of the Ministry of Health. The main objective of the session was to carry out a demo of the solution, project objectives and activities and get feedback and buy-in from the ministry.

Public-private sector

The project teams were able to engage with Joint Medical Stores and Management Sciences For Health, Inc. to present the digital solution and preliminary results from the pilot. The team sought suggestions on how to leverage the solution to improve supply chain management at the lower-level health facilities, strengthen Public-Private Partnerships, and explore avenues for synergies for the sustainability of the project.

Local district leadership

The local district leadership supports oversight of drug redistribution within the district. This made it pivotal to engage with the leadership in Kiryandongo District comprised of the Resident District Commissioner, District Health Officer, and Chief Administrative Officer to present overall project objectives and sign an MOU to facilitate smooth operations and support in project implementation.

Implementing partners

MAUL held introductory meetings with the Manager, Medical Logistics & Supply Chain System – Baylor Uganda. Baylor is taking over from the Infectious Diseases Institute as the new implementing partner in Kiryandongo District. The engagement was centred around providing a brief introduction to the project and discussing possible synergies to ensure sustainable and successful execution.

5. Partnerships

The project has been nurturing several partnerships to build a sustainable project operation. Early on, the team engaged the services of a local technician in Kiryandongo to help support hardware installations. This was beneficial in terms of reduced costs of deployment, local job creation, and establishing a more accessible line of support if a hardware replacement at the site level was required.

The project also formed partnerships with a local clearing firm, Flitlinks, which was beneficial in providing guidance and support to facilitate faster tax clearance for all systems and hardware peripherals shipped from overseas.

Expected Outcomes

This new approach to digitalization creates an integrated solution to the most pressing problems for lower-level facilities where roughly 90% of supply chain data cannot be digitalized reliably.

As opposed to managing multiple vendors and service providers, the project will provide 100% digital uptime while offering local support and repair when and as needed. By removing the technology burdens on the end-users and leveraging blockchain technology to connect and network throughout the health system, a new digital health system can be realized.

Despite poor infrastructure noted at the majority of the lower-level health facilities in Kiryandongo, the system was able to register 100% uptime at facilities; 100 % data sync between facilities; ability to pick up signals from various service providers (MTN, Airtel & Uganda Telecom) and connect to the most robust network thereby eliminating any possible connectivity drops.

Preliminary data obtained from the size of block graph after two weeks' usage at the four deployed facilities estimate internet costs for data requirements for the entire district at about 4.3GB per year, including firmware updates. This is considerably cheaper than the current 10GB provided to facilities per month to support stock status reporting by implementing partners.

These system-wide efficiencies will create a more digitally inclusive and robust health system, realizing savings and efficiencies throughout the system, and unlocking valuable capital for investment beyond the ICT layer.

Conclusion

In summary, challenges facing stock management in lower-level health facilities include inadequate inventory practices, perennial stock out of LMIS tools, lack of data visibility of site-level stock to the district and central level owing to poor IT infrastructure, limited electronic Logistics Management Information Systems penetration, health logistics work gaps characterized by limited personnel, and high workload that impede the district and national supply chain. These can be remedied through digitalizing the inventory management processes at lower-level health facilities and ultimately improving the management of essential medicines at lower-level health centres in Uganda.

Acknowledgements

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LEAVING NO ONE BEHIND IN THE DIGITAL ERA

The UNCDF strategy 'Leaving no one behind in the digital era' is based on over a decade of experience in digital financial inclusion in Africa, Asia and the Pacific. UNCDF leverages digital finance in support of the Sustainable Development Goals (SDGs) to achieve the vision of promoting digital economies that leave no one behind. The goal of UNCDF is to empower millions of people by 2024 to use services daily that leverage innovation and technology and contribute to the SDGs. To achieve this vision UNCDF uses a market development approach and continuously seeks to address underlying market dysfunctions that exclude people living in the last mile.

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