

OPTIMIZE

South Sudan

Report

September 2013



OPTIMIZE

Immunization systems and technologies for tomorrow



This report was commissioned by Optimize: Immunization Systems and Technologies for Tomorrow, a collaboration between the World Health Organization (WHO) and PATH. The report was authored by Jan Grevendonk from WHO, Anuph Akkihal from Logistimo, and Morris Gargar (consultant).

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ACRONYMS

The following acronyms are used in this document.

BCG	bacillus Calmette-Guérin
BEG	Bahr el Ghazal
DTP	a combination vaccine containing diphtheria, tetanus toxoid, and pertussis vaccines
DTP-3	third dose of DTP
EPI	Expanded Programme on Immunization
GPRS	general packet radio service
IT	Information technology
LMIS	logistics management information system
OPV	oral polio vaccine
PATH	Program for Appropriate Technology in Health
SMS	short-message service
TT	tetanus toxoid
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1. BACKGROUND

1.1. About project Optimize

Project Optimize, a five-year partnership between the World Health Organization (WHO) and PATH, was established to identify ways in which supply chains can be optimized to meet the demands of an increasingly large and costly portfolio of vaccines.

Optimize worked directly with national governments and other institutions to identify problems in the supply chain and test innovative solutions. We also worked with vaccine manufacturers and policymakers to help ensure that new products and policies enable supply chain systems to function effectively. The goal was to help define an ideal vaccine supply chain that can be used to develop stronger, more adaptable, and more efficient logistics systems, extending the reach of lifesaving health technologies to people around the world.

For more information, please visit these Optimize websites:

PATH: www.path.org/projects/project-optimize

WHO: www.who.int/immunization_delivery/optimize

1.2. Immunization in South Sudan

South Sudan is the youngest and one of the poorest nations in the world, with about half of its population (50.6%) living on less than US\$1.00 per day, according to a 2006 household survey. The vast majority of the population is engaged in rural subsistence farming and cattle herding. South Sudan's economy is one of the world's weakest and most underdeveloped; the country has very little existing infrastructure, and as of 2011, the highest maternal mortality and female illiteracy rates in the world. According to a census carried out in April 2008, the population of South Sudan was 8,260,490.

South Sudan is administratively divided into 10 states and 80 counties. Counties are further divided into 605 payams, 2,532 bomas, and 26,544 major villages. The nationwide Expanded Programme on Immunization (EPI) covers all states, counties, and payams. All immunization services are delivered free of charge through fixed immunization centers (primary health care facilities), community-based outreaches, vaccination campaigns, and mobile clinics as part of integrated child health survival services. The United Nations Children's Fund (UNICEF) provides all funding for procurement and distribution of all vaccines and ancillary items of the cold chain system.

There is 1 central cold chain situated in Juba, 10 state cold chains, and 79 county cold stores. Due to the limited capacity of the cold chain system and lack of functioning health care facilities in some areas, a monthly outreach using fast cold chain is the primary means of reaching most of the target population. The program further relies heavily on acceleration campaigns to reach the target population due to the limited number of primary health care facilities implementing routine immunization. These are primarily supported by WHO.

EPI faces a number of challenges such as a continued armed conflict and a lack of human resources and skilled staff. Moreover, South Sudan is a new country with multiple competing health priorities, an emerging humanitarian crisis due to influx of returnees from the north, and

a shortage of financial resources. Presently there is no line item for immunization within the national budget.

Despite these challenges, the program made significant improvement and achieved over 60% DTP-3 (third dose of diphtheria-tetanus toxoid-pertussis vaccine [DTP]) coverage in the last two years. Nevertheless, this remains below national, regional, and global targets of 90%. Additionally, there are wide coverage disparities between the states and within each state (between counties).

1.3. Logistics management information systems

An Effective Vaccine Management assessment, conducted in February 2012, highlighted the following findings of vaccine stock management in South Sudan:

- Only 49% of the counties had sufficient stock and were able to supply the lower levels at time of review. Out of the 389 facilities visited with cold storage, 113 reported vaccine stockouts during the previous year, 167 reported no stockouts, and 109 reported that they did not know.
- No computerized stock management tools were used at any level.
- Only 34% of the facilities visited record transactions within 24 hours of conclusion.
- No facility had tools that capture all relevant information on vaccine and consumables.
- No facility had all matching vouchers and ledgers during the period under review.
- The stock recording system does not provide for recording damaged vaccines, and only 2% of the facilities visited were conversant with procedures for handling damaged vaccines and reviewing damaged/loss records.
- Only 6% of the facilities had set minimum and maximum stock levels, while no facility kept their stock within these limits during the review period.
- Only 24% of the facilities visited had conducted and documented the required number of physical inventories of vaccines during the review period.
- Only 24% of 39 facilities had vaccine records matching diluent records.
- There was no cold chain equipment inventory.
- Vaccine utilization monitoring, integrated with routine EPI reporting, was usually incomplete.



Photo: PATH/Morris Gargar

Challenging cold chain conditions in South Sudan

1.4. Logistimo

Clearly, one of the challenges for further improvements now is the lack of good data at all levels and across functions. In logistics, for example, there is no visibility about stock levels, consumption rates, and stockouts below the national level. Often, replenishment orders arrive only after a stockout already occurred.

At the same time, mobile phone network coverage is growing fast, and simple software systems with low information technology (IT) infrastructure requirements are available to support immunization program logistics. This new technology may provide an opportunity to develop new information systems, to support immunization logistics, and to ensure the coordination of international agencies involved in immunization in South Sudan.

Logistimo India Private Limited is an India-based research, development, and social enterprise offering a stock and order management tool accessible through basic mobile phones and through the Internet (see Figure 1). It is provided as a cloud-hosted service and uses simple-to-use software with low IT management and hardware requirements. For more information about Logistimo please visit www.logistimo.com.

Figure 1. Logistimo's model allows access to the cloud through both the web and mobile phones



1.5. Finding more information

Table 1 provides key resources on the activities implemented in South Sudan.

Table 1. Key resources providing more information on the activities implemented in South Sudan

Type	Title	Description	Reference
Document	A Case for Better Immunization Information Systems	Discusses the rationale for improving immunization information systems and describes user experiences with different types of systems.	 http://www.path.org/publications/detail.php?i=2337 or http://www.who.int/immunization_delivery/optimize/resources/en/index5.html
Video	Immunization Information Systems: Logistimo in South Sudan	Overview video about this activity. This short video shows how Logistimo works and examines the impact it has had in South Sudan.	 http://www.youtube.com/watch?v=Sr7rCnpLWyM

2. OBJECTIVES

The goal of the activity was to test the feasibility and usefulness of implementing a mobile and cloud-based vaccine stock management information system capable of providing EPI staff at all levels timely access to vaccine stock and demand data. The objectives of the system are:

- To generate accurate and useful data that can be used to improve the management of the vaccination program.
- To improve vaccine stock management by providing better control over buffer stocks and wastage, enabling vaccine supply to be more closely matched with demand.
- To improve accountability of health workers to report on consumption, stock status, and wastage.

3. PROJECT OPTIMIZE IN SOUTH SUDAN

3.1. Key events

Unlike the Optimize demonstration projects,ⁱ this was a smaller, time-limited effort aimed at one implementation activity only. It ran about one year from the time the first visit took place, and the activity will only be sustained if the Ministry of Health and immunization partners in South Sudan see enough value in its continuation. Table 2 shows the timeline and major milestones.

Table 2. Activity timeline and major milestones

Year	Month	Event
2012	March	Initial visit by Optimize and Logistimo staff to discuss the proposed project with EPI national staff, the WHO country office, and the UNICEF country office. Training for EPI managers from all states and county managers in Central Equatoria State.
2012	September	Logistimo was awarded a Phase 1 Grand Challenges Explorations grant from the Bill & Melinda Gates Foundation.
2012	September	Hired a full-time coordinator (Morris Gargar).
2012	December	Provided refresher training at all levels.
2013	March	Pilot evaluation completed.
2013	May	End of project Optimize support to the implementation activity; all activity work was taken over by local WHO and UNICEF offices.

Abbreviations: EPI = Expanded Programme on Immunization; UNICEF = United Nations Children’s Fund; WHO = World Health Organization.



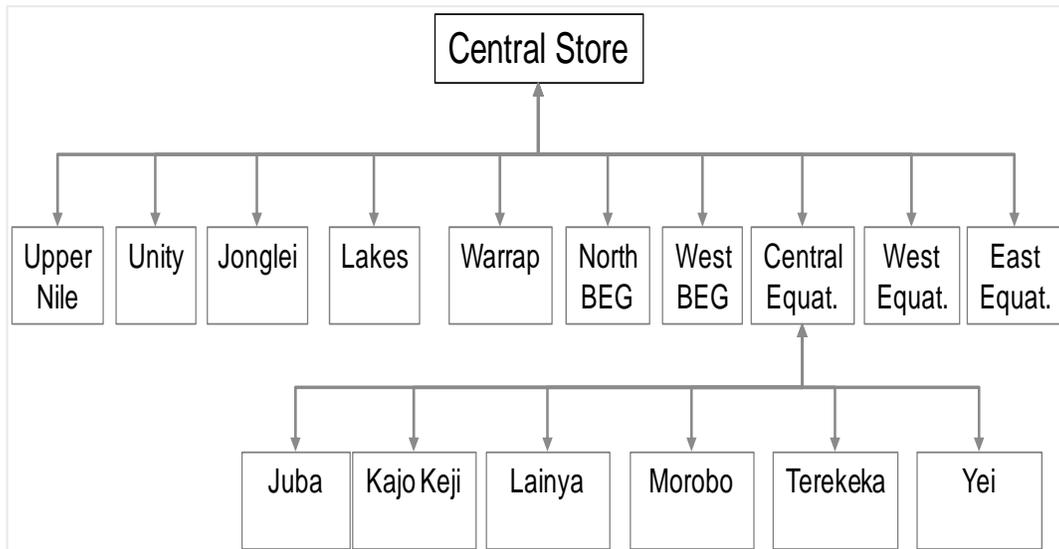
Photo: PATH/Jan Grevendonk

A county stock manager receives training in how to use the LogiWeb mobile phone application.

ⁱ For more information on the demonstration projects, please visit our country report series: <http://tinyurl.com/nbezzyj>.

The activity was limited in time and also in scope. The involved entities are depicted in Figure 2.

Figure 2. Entities involved in the implementation activity in South Sudan



Abbreviations: BEG = Bahr el Ghazal; Equat. = Equatoria.

3.2. Investment and costs

Apart from staff and travel costs for its own staff, Optimize provided funding of about \$32,000. This funding covered mainly training needs as well as the provision of airtime and mobile phones for the pilot users. Logistimo provided the use of the software free of charge for a duration of two years. Note: Logistimo is offered in software as a service model, and the company normally charges around US\$3 per user per month. That fee covers hosting and transaction costs, as well as further development of the software.

Implementation costs are estimated at:

- \$500 per user for training (although training could be integrated into other training programs).
- \$100 per user for a mobile phone at local market prices.

At the national scale, there would be about 100 users in states and counties, and full implementation would, therefore, cost around \$60,000.

Running costs are estimated at:

- \$3 per month for airtime.
- \$3 per month for Logistimo hosting fees.

At the national scale, this would amount to \$600 per month or \$7,200 per year. To this, a provision for phone replacement and refresher training should also be added.

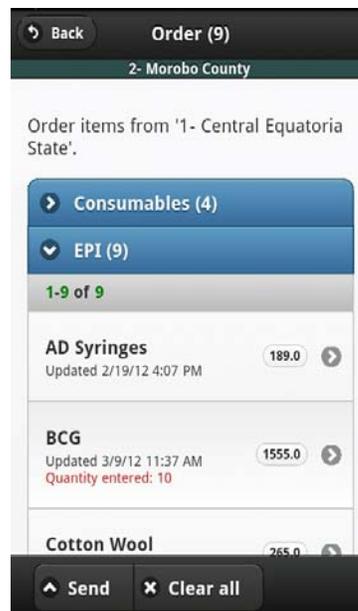
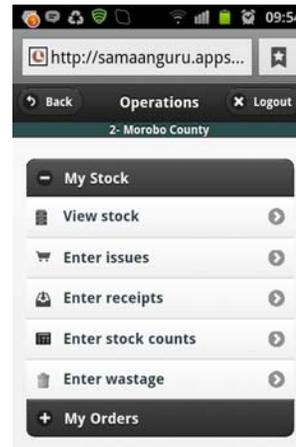
3.3. How the system works

The Logistimo mobile phone application, called LogiMobile, can be used on common, low-cost mobile phones; the application itself requires only two hours of training for the operator to become proficient. Using a simple graphical interface, county stock managers record vaccine stock levels by navigating a standard mobile phone interface. The screens show both the Android and the Java phone interface.

Users can enter how much stock they have at that moment, how much they have issued to patients or to other clinics, or how much has been damaged or expired.

The stock update is then sent from the mobile phone to the Logistimo logistics management information system (LMIS) using a GPRS (general packet radio service) connection or by SMS (short message service) text message if GPRS is unavailable. (Although it requires a network connection for the operator to register an update, LogiMobile can also work in off-line mode by storing GPRS or SMS updates and sending them as soon as a connection becomes available.)

It is just as easy for county stock managers to order vaccines. Once made, the request is immediately recorded in the Logistimo LMIS for national or state managers to review and approve. To help ensure the request is dealt with promptly, Logistimo can also be configured to automatically send an SMS message to the manager to notify them of pending orders.



Once an order has been received, state managers can validate and ship those orders using LogiMobile or the browser-based component of Logistimo, named LogiWeb. The system can then notify the county stock manager by sending an SMS text message with details of the manager’s response (for example, “Your order has been processed and will be delivered on 12/12/2012”). When the shipment arrives, county stock managers can then record the arrival on their mobile phones. Each stage of the process is recorded in the Logistimo system.

Order	Items	Price	Status	Entity	Created on	Vendor
5652009	8	USD 19911.29	pending	2- Warrap State, Kuajok	3/19/13 12:15 PM	1- National Level, Juba
5550075	2	USD 433.80	confirmed	3- Terekeka, Terekeka	3/14/13 2:41 PM	2- Central Equatoria State, Juba
5177323	4	USD 4058.97	pending	2- Western Equatoria, Yambio	2/25/13 4:36 PM	1- National Level, Juba
5170206	13	USD 3632.27	confirmed	3- Yei, Yei	2/19/13 11:00 AM	2- Central Equatoria State, Juba
5151370	13	USD 46195.05	confirmed	2- Central Equatoria State, Juba	2/18/13 11:24 AM	1- National Level, Juba
5055706	3	USD 30.60	confirmed	2- Western Bah el Ghazal, Wau	2/14/13 9:05 AM	1- National Level, Juba
5024234	1	USD 238.00	confirmed	3- Terekeka, Terekeka	2/8/13 12:09 PM	2- Central Equatoria State, Juba
					1/8/13 11:51	3- Central Equatoria State, Juba

As well as being used to record stock levels and the progress of orders, the Logistimo LMIS can also be used to guard against stockouts. Should stock levels fall below a minimum level without the county stock manager ordering a new shipment, the Logistimo system can be configured to automatically warn county stock managers of low stock levels. For example, it can send an SMS message to the user with a warning that new stock needs to be ordered.

The browser-based component of Logistimo, named LogiWeb, contains all the functionality of LogiMobile, but can also be used to report on stock availability and consumption in real time across the country. Users can manage their orders, track inventory problems throughout the country, and report on consumption trends to aid in forecasting and procurement.

Material	Stock	Re-order level
AD Syringe 0.05 ml (pcs)	164100	0
AD Syringe 0.5ml (pcs)	4459600	0
BCG (Doses)	278260	0
BCG Diluent (Doses)	377080	0
bOPV (Doses)	1800	0
Child Health Card (pcs)	2500	0
Cold Box (pcs)	450	0
Cotton Wool (pcs)	20	0
DPT (Doses)	434580	0
Ice-Lined Refrigerator (pcs)	79	0
Kerosene Refrigerator (pcs)	8	0
Measles Diluent (Doses)	329400	0
Measles Vaccine (Doses)	346210	0
OPV (Doses)	542120	0
Reconstitution Syringe 2ml (pcs)	118300	0
Reconstitution Syringe 5ml (pcs)	285500	0
Safety Box (pcs)	73075	0
Solar Refrigerator (pcs)	15	0
TT (Doses)	2550700	0
TT Card (pcs)	349600	0
Vaccine Carrier (pcs)	70	0

4. RESULTS

A cloud-based LMIS that uses mobile phones to register stock transactions and submit orders for additional stock has the potential to simplify stock ordering, saving time currently spent by stock managers preparing and sending paper orders. It also has the potential to make stock data more accessible, enabling state managers to make ordering or dispatch decisions according to reliable and easy-to-understand data in real time. These were the observed results.

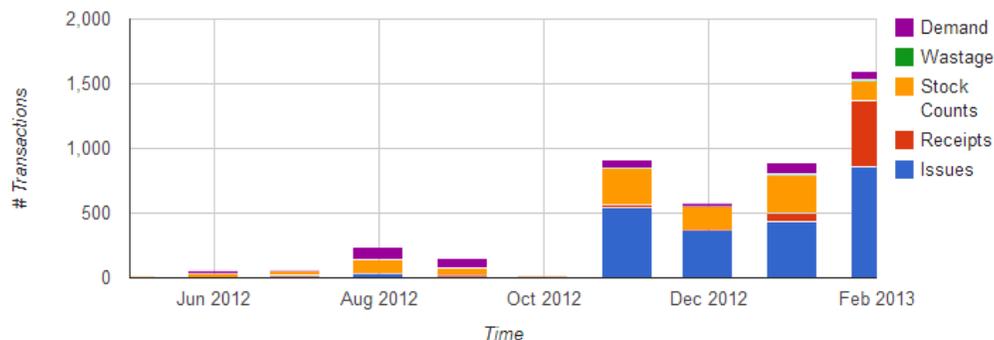
4.1. Feasibility

Logistimo does not require the installation of a central server, as the data are kept in the cloud (in Google databases), which means that the application is highly scalable. The only deployment activities that need to be done are the preparation of client devices (phones) and training of users. The training of the mobile phone module takes less than a full day, and the use of the web client takes a full training day. The feasibility of this kind of application is shown by its uptake statistics below.

4.2. Uptake and use

After a slow start in early 2012, the system use took off after the recruitment of a local coordinator in September 2013. Figure 3 shows user activity for the entire period.

Figure 3. User activity of the Logistimo system from June 2012 to February 2013



This success was not uniform, however; by the end of the project, two states and two counties still did not use the system at all, mostly because of staff turnover.

4.3. Data quality

In order to authenticate the data sent through Logistimo, a comparison was made between paper-based records and data in Logistimo. Without prior notice, the paper record was assessed and a physical inventory of vaccines was done at the cold store of Central Equatoria for the month of February 2013. Table 3 below shows that both the paper-based records and the Logistimo records still showed discrepancies.

Table 3. Comparison between count of paper-based records to Logistimo records by antigen

Antigen	Paper based	Logistimo record	Physical count
BCG	33,200	31,200	31,200
DTP	53,250	52,450	61,610
Measles	14,050	14,550	14,550
OPV	82,060	88,600	81,060
TT	77,880	77,880	77,880

Abbreviations: BCG = bacillus Calmette-Guérin; DTP = diphtheria, tetanus, toxoid; OPV = trivalent oral polio vaccine; TT = tetanus toxoid.

4.4. Impact on stock management practices

Logistimo affected the following aspects of stock management during the pilot in South Sudan:

1. Helped users to understand vaccine needs, establish safety stock margins, and optimize order quantities

Vaccine stores at all levels need to maintain an appropriate safety stock level. If they do not keep enough vaccine, they risk stockouts, but if they store too much vaccine, they risk wasting perishable stock. Stock managers and vaccinators alike can maintain an appropriate level of stock by ordering the right quantities based on their knowledge of how much they have and how much they estimate they will need during the time the order is supposed to cover.

Since the states receive vaccines on a quarterly basis, they need at least three months of stock at the beginning of a quarter, plus some buffer stock to avoid stockouts at the end of the quarter. For the counties, one month of buffer stock is usually considered to be an adequate level. That way, the states will not run out of vaccines if the next shipment arrives a few weeks late or if for some reason they need more stock. Rational levels of stock are thus maintained between a minimum of one month and a maximum of four months.

By providing real-time visibility on stock balances, as well as the data necessary to estimate demand (including average monthly consumption for each vaccine), Logistimo enables users to make better-informed decisions on the quantities of vaccine stock to order, as the system automatically calculates the safety stock level of each antigen.

2. Provided an alert system

Stock managers in South Sudan received instant notifications through SMS and email on a weekly and monthly basis, including:

- **Orders**—fulfillment due, no order activity, order created, order expired/untouched, order modified, and order status changed.
- **Inventory**—no inventory activity, out of stock, stock count differs from current stock, stock counted, stock issued, stock received, stock wasted, and unsafe stock (< MIN).

These alert messages served as reminder, which has helped to regularize stock data and improve consistency in inventory transactions.

3. Made the ordering process easier and faster

Life was made easier for people because no paper orders need to be prepared and sent to the higher levels. The logistics of sending paper forms in South Sudan are complicated, while the phone network is readily available.

5. CONCLUSIONS AND LESSONS LEARNED

The implementation activity showed that new technology, including mobile phones and cloud-based systems, are feasible in even the most challenging conditions and are quite acceptable by system users. They can also make a real difference for program management and performance.

Critical success factors were:

- Responsiveness to user needs and requirements to make sure that software responds to these needs.
- Local ownership and support from management.
- Training and refresher training of all users, with lots of post-implementation support.

However, longer-term sustainability is not assured, and the system will likely only be used to the extent that immunization partners support it.