IMMUNIZATION INFORMATION MANAGEMENT IN NIGERIA'S LAST-MILE

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BACKGROUND

In 2012 the Federal Government of Nigeria launched the Saving One Million Lives Initiative initiative with objectives in immunization including the development of a comprehensive and effective reporting system for vaccine supply chains and feedback mechanisms necessary for corrective management.

The initiative faces an increasingly complex service-delivery landscape; the EPI routine is growing by 88% in 24 months. Investments in cold chain storage capacity across Nigeria's 484 wards is establishing in effect a new tier of the supply chain and asking health workers to manage stock for the first time.

While numerous information system initiatives are underway, all are dependent on paper based data collection tools which are completed, delivered and collated in slow, error-prone processes which impose severe data quality, timeliness and adaptability issues.

LAST MILE DATA

Data gathering in the last mile comes with a unique set of challenges and has traditionally been approached by extending paper recordkeeping practices. This approach represents a **rate-limiting factor** for service delivery strengthening.

Paper and hybrid systems incur **high costs in printing, distribution and reporting logistics,** impose severe **reporting frequency limits**, **transcription and data entry errors,** provide **limited workflow support**, and cannot provide data management capabilities to end users, missing huge opportunities in **empowerment and accountability**. Electronic data collection tools promise dramatic improvements over paper based systems, but often fall short in delivery. They must contend with

- low literacy levels
- unreliable or absent network connectivity
- logistical challenges in training and followup
- challenges of deployment scale

EXISTING SYSTEM

🚚 MOVE

Based on a request from the Kano State Government for support in RI supply chain management, eHealth Africa in 2014 began the Move project. Executed entirely in Kano, it produced a design process and a technical stack which addresses many of the key challenges in digital data collection in the last mile. It also produced a mobile application for last mile supply chain management, Move.
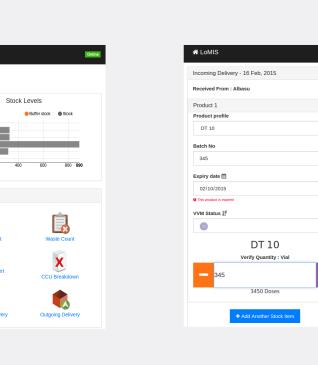
DEVELOPMENT PROCESS

An acknowledgement must be made that user needs in the last mile context are almost impossible to anticipate.
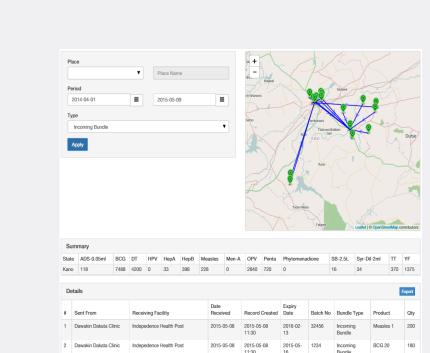
Our approach, based on Design Thinking and agile practices, emphasizes interviews with primary users, intent-oriented requirements and iterations of rapid prototypes and user testing. App analytics can be used even after deployment to target unused or unusable features for refinement or removal.

It is essential that last mile tools are not only attractive and usable, but also intuitive enough to be easily taught or learned without support or need for extensive ToTs.

In-person followup, by person or by phone, was identified early on as an essential element of successful deployment, and plays an important role in weaving use of the technology into daily practice.

Technology is easier to modify than behaviour. Move began by digitizing existing processes and serving stakeholders routine data. Quantitative analytics can now be used to quantitatively identify and advocate for process improvements.

FEATURES

Stock Management Workflows | Users are guided through **stock counts** with intelligent UI prompts, driven by reminders from facility-specific schedules and facility-specific inventory.
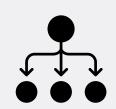
Incoming and outgoing ledger workflows include dynamic batch registration which is shared across the network, allowing managers insights into the formal and informal workings of the state supply chain.

Exception Alerts | Users are able to report structured **stock out** and **CCE breakdown alerts** which are broadcast to relevant supply chain officers for rapid response. In the event that a user is without data connectivity these alerts are seamlessly transferred over SMS.

On-device Analytics | Inventory levels are calculated against target and buffer levels as defined by national standards, giving in-charges immediate feedback on the health of their inventory, empowering them in inventory planning, and promoting accountability.

Last Mile Design

Offline-first Operation | Application works completely offline, data sync occurs in the background as connection becomes available even when the application is closed, making for a reliable, effortless reporting mechanism.

Data Quality Checks | Standardized product profile data allows for intelligent validation to ensure data quality from the moment of entry, eliminating the need for manual cleaning of basic data entry errors.

User Validated UI | Test driven interface design includes high contrast theming for outdoor operation, graphical prompts and intuitive unit switching based on common conventions. Activity flow and UI control design has increased speed of stock outs by 130% over conventional PDA based survey tools and paper.

ANATOMY

Offline First

Document storage for ease of versioning and rapid deployment of new data collection pieces - data can be in heterogeneous formats and still be used for storage and analysis, supporting interoperability

Partial replication in couchdb enabling data shuttling and automatic consistency between clients

In-app storage uses pouchdb enabling the app to operate reliably offline almost indefinitely, and sync data opportunistically

Fallback to SMS transport to allow priority data to be transferred in absence of a data connection

Deep Analytics Capabilities

Elasticsearch on couchdb for performant search, analytics and visualization even over vast quantities of data, and complex keys

Offline analytics use the same business intelligence modules over on-device data, providing rich analytics and visualizations to mobile users

Rapid UX-centric Development

Data architecture makes **new and prototype features much faster to develop** as well as enabling designers to stay focused on the user needs without arbitrary limitations of storage schema

Use of **HTML5/javascript** stack based on cordova enables developers to use well developed web technologies and skills for rich UI, and allows us to target multiple platforms

Technical Challenges

The data storage platform uses **bleeding edge technology** and has required ongoing contributions by our team to make more robust and performant.

The document oriented paradigm used is highly flexible and enables rapid development, but **does not benefit from the existing ecosystem** of tools surrounding more mature paradigms

The querying engines used work well for complex static reports, but are **poorly suited to ad-hoc queries**. We take this as an acceptable trade off.

Workflow diagram: HEALTH FACILITIES → LOCAL GOVERNMENT AREA STORES → STATE STORES → HEALTH FACILITIES → DATA FOR MANAGEMENT ENVIRONMENT

CHALLENGES

Coordinating design amid rapid changes in the policy, program, and technology landscape remains an issue, especially in the absence of governance for applications of technology to public health. The design approach presumes **strong deployment capabilities** to test, train and iterate in the context for which the application is intended

Long term maintenance and support arrangements, while standard considerations in private sector technology projects, are not well accepted or easily provisioned in the public health context

OPPORTUNITIES

On the strength of initial pilots, Move has been integrated into the state's program and will **rollout to all of Kano's 1000+ facilities** in 2015. **Integrations with national platforms** including **NAV and DHIS2** will improve data quality and create unprecedented reach for these core information systems.

Costs of paper systems are considerable, ongoing, and when added to lost vaccine opportunities or stock resulting from management gaps, represent a significant burden on health systems. An **assessment of the total cost of ownership** of digital platforms against extant systems needs to be conducted.

The deployment of smart-phone based platforms is an powerful investment, costs will be ameliorated as **adjacent programs leverage existing digital infrastructure and learnings**.