Evaluating the Impact of Introduction of an Electronic Logistics Management Information System and a Logistics Management Unit

Marasi Mwencha, John Snow, Inc.

Dakar, Senegal
Tanzania’s public health supply chain delivers a range of products to over 5000 health facilities.
Implementation approaches for the eLMIS and LMU

- **eLMIS requirements established**
- **Orientation of the LMU team begins**
- **LMU Implemented**

Sept 2011 - **Orientation of the LMU team begins**
Oct 2013 - **LMU Implemented**
Nov 2012 - **TZM eLMIS software development launched**
Nov 2013 - **eLMIS national roll out begins**
Jan 2014 - **Orientation of LMU GF team**
Mar 2014
**Management Upgrade Theory of Action**

**eLMIS Intervention:**
- SC process upgrade
- Web-based access
- Nationwide rollout of SMS reporting of inventory

**Improved Reporting:**
- Frequency
- Quality
- Timeliness

**Improved Data:**
- Accessibility
- Visibility
- Transparency
- Timeliness

**Better SC Management Practices:**
- Quantification
- Storage
- Transport
- Data management
- Intervention design & planning
- Monitoring & evaluation
- Control

**Better SC Outcomes:**
- Product Availability
- Procurement
- Inventory management
- Forecasting
- Reduced Expiries
- Greater cost efficiency

**LMU Intervention:**
- Data mgmt.
- Quantification
- Supervision
- SC intervention planning
- M&E
- Coordination & collaboration
- Data visibility
- Training and capacity building

**Increased use of health services**

**Better health outcomes**
This evaluation looks at the impact of investment in the eLMIS and LMU on performance and cost.

Compared to the previous management systems:

- Are they more effective?
- What do they cost?
- Are they more efficient?
- Are they saving money?
The study design contemplates at least three rounds of data collection:

<table>
<thead>
<tr>
<th>Type of observation</th>
<th>Baseline</th>
<th>Upgrades begin</th>
<th>Round 2</th>
<th>Round 3*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance data</td>
<td>$O_1$</td>
<td>$X$</td>
<td>$O_2$</td>
<td>$O_3$</td>
</tr>
<tr>
<td>Cost data</td>
<td>$O_4$</td>
<td>$X$</td>
<td>$O_5$</td>
<td>$O_6$</td>
</tr>
</tbody>
</table>

O = Observation (data collection); X = Intervention

* Round 3 data collection depends on availability of funding under the follow-on project.
The study focuses on **HIV, EPI, and ILS** commodity groups:

<table>
<thead>
<tr>
<th>Commodity group</th>
<th>Number of commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>10</td>
</tr>
<tr>
<td>EPI</td>
<td>2</td>
</tr>
<tr>
<td>ILS</td>
<td></td>
</tr>
<tr>
<td>Reproductive Health</td>
<td>9</td>
</tr>
<tr>
<td>Malaria</td>
<td>9</td>
</tr>
<tr>
<td>Other Essential</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>
The data draws from a **nationally representative sampling** of facilities.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Data Source</th>
<th>Program Focus</th>
<th>Measurement Focus</th>
<th>Data Collection Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUV Survey-Modified</td>
<td>~220 health facilities (hospitals, health centers and dispensaries)</td>
<td>ARV, ILS, OI, TB, EPI</td>
<td>Cost and performance at facility level</td>
<td>Aug 2013, April 2015</td>
</tr>
<tr>
<td>Upstream SC Survey</td>
<td>17 districts, 9 MSD zonal stores, 10 regional vaccine stores, MSD HQ</td>
<td>ARV, ILS, OI, TB, EPI</td>
<td>Cost and performance at higher tiers of the SC</td>
<td>Oct 2013, May 2015</td>
</tr>
</tbody>
</table>
Methodology

Cost and throughput data is collected at different levels of the supply chain:

<table>
<thead>
<tr>
<th>Category of data collected</th>
<th>Type of information collected</th>
<th>Level and instruments used for data collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SDP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>District Offices, District and Regional Vaccine Store</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSD HQ and Zonal Stores</td>
</tr>
<tr>
<td>Cost</td>
<td>Resource use</td>
<td>EUV – modified</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supply Chain Costing Tool (SCCT) – modified;</td>
</tr>
<tr>
<td></td>
<td>Prices</td>
<td>MSD financial records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOHSW records</td>
</tr>
<tr>
<td></td>
<td>Prices</td>
<td>MOHSW records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSD financial records</td>
</tr>
<tr>
<td>Throughput</td>
<td>Quantities</td>
<td>ERP, LMIS, report review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ERP, LMIS, report review</td>
</tr>
<tr>
<td></td>
<td>Prices</td>
<td>ERP, MSD financial records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSD, donor financial records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSD financial records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSD financial records</td>
</tr>
</tbody>
</table>
Performance indicators for comparison:

**Methodology**

- Data use
  - Accessibility of data
  - Visibility of data
  - Timeliness of data
  - Transparency of data

- Reporting
  - Frequency of reporting
  - Timeliness of reporting
  - Quality of reporting
  - Reporting rates

- Supply chain outcomes
  - Product availability
  - Inventory management
  - Reduced expiries
  - Forecast accuracy

**Management practices**

- Storage
- Inventory management
- Transport
- Logistics data management

- General management
- Quantification
- Control and monitor
- Design and plan
Other **environmental factors** potentially affecting impact of the interventions:

- **MSD debt levels** have increased to ~$56 million, hampering the organization’s ability to effectively undertake operations including distribution of commodities to health facilities.

- With support from the project, MSD begins to optimize distribution routes, following the introduction of direct delivery, leading to improvements in lead time and cost savings of up to 30%.

- Pooled Procurement Mechanism (PPM) takes over the procurement of ARVs and anti-malarials from MSD and SCMS.

- Shift in the first line ART regimen to TLE, which experiences global shortages.
QUALITATIVE FINDINGS OF eLMIS AND LMU IMPLEMENTATION
Qualitative findings of eLMIS and LMU implementation

In focus groups, district pharmacists reported reduced complexity and high levels of satisfaction with eLMIS:

<table>
<thead>
<tr>
<th>TASKS</th>
<th>INDICATOR</th>
<th>Number of district pharmacists:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor and follow up on reporting rates and timeliness</td>
<td>eLMIS has helped</td>
<td>Yes/ Improved</td>
</tr>
<tr>
<td></td>
<td>eLMIS has made task easier</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Level of satisfaction with task</td>
<td>No/ Not improved</td>
</tr>
<tr>
<td>Analyze commodity availability across the district</td>
<td>eLMIS has helped</td>
<td>Yes/ Improved</td>
</tr>
<tr>
<td></td>
<td>eLMIS has made task easier</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Level of satisfaction with task</td>
<td>No/ Not improved</td>
</tr>
<tr>
<td>Make redistribution decisions</td>
<td>eLMIS has helped</td>
<td>Yes/ Improved</td>
</tr>
<tr>
<td></td>
<td>eLMIS has made task easier</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Level of satisfaction with task</td>
<td>No/ Not improved</td>
</tr>
<tr>
<td>Analyze budgets of facility orders</td>
<td>eLMIS has helped</td>
<td>Yes/ Improved</td>
</tr>
<tr>
<td></td>
<td>eLMIS has made task easier</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Level of satisfaction with task</td>
<td>No/ Not improved</td>
</tr>
<tr>
<td>Internal performance reviews</td>
<td>eLMIS has helped</td>
<td>Yes/ Improved</td>
</tr>
<tr>
<td></td>
<td>eLMIS has made task easier</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Level of satisfaction with task</td>
<td>No/ Not improved</td>
</tr>
<tr>
<td>Supervision of facilities</td>
<td>eLMIS has helped</td>
<td>Yes/ Improved</td>
</tr>
<tr>
<td></td>
<td>eLMIS has made task easier</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Level of satisfaction with task</td>
<td>No/ Not improved</td>
</tr>
</tbody>
</table>
The same group reported that the LMU has helped make positive changes.
Anecdotal evidence points to generally positive changes

<table>
<thead>
<tr>
<th>Supply Chain Performance</th>
<th>Reduction in stock outs; fewer reports (&quot;complaints&quot;) of stock outs to MSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Practice</td>
<td>Data facilitating redistribution within and among districts; MSD reports fewer “push” orders</td>
</tr>
<tr>
<td>Reporting</td>
<td>Frequent reports of better and more timely reporting and ordering; more accountability at lower levels</td>
</tr>
<tr>
<td>Data Use</td>
<td>Orders more likely to be based on consumption or issues; ability to validate order quantities and inventory levels; ability to inform program commodity decisions</td>
</tr>
<tr>
<td>Other Mgmt Practices</td>
<td>More follow up with facilities that don’t order; ability to prioritize supervision needs</td>
</tr>
</tbody>
</table>
Data use mostly **improved** on a range of dimensions:

<table>
<thead>
<tr>
<th>Round 1 vs. Baseline</th>
<th>ARV</th>
<th>ILS-Malaria</th>
<th>ILS Essential Med</th>
<th>ILS Fam Plan &amp; MNCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Accessibility</td>
<td>Better</td>
<td>Same</td>
<td></td>
<td>Better</td>
</tr>
<tr>
<td>Data Visibility</td>
<td>Better</td>
<td>Better</td>
<td></td>
<td>Better</td>
</tr>
<tr>
<td>Data Timeliness</td>
<td>Same</td>
<td>Same</td>
<td></td>
<td>Better</td>
</tr>
<tr>
<td>Data Transparency</td>
<td>Same</td>
<td>Better</td>
<td>Better</td>
<td>Better</td>
</tr>
</tbody>
</table>

**Data Accessibility:** Access to inventory and issues data from sites across supply chain by sponsors.

**Data Visibility:** Appropriateness of both data quality and effort to access data for sponsors.

**Data Timeliness:** Frequency and delay in updating data available to sponsors.

**Data Transparency:** Whether sites across the supply chain generally share inventory and issues data centrally.
Results: Performance

Quantification and other management practices showed improvement:

<table>
<thead>
<tr>
<th>Round 1 vs. Baseline</th>
<th>ARV</th>
<th>ILS-Malaria</th>
<th>ILS Essential Med</th>
<th>ILS Fam Plan &amp; MNCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantification</td>
<td>Same</td>
<td>Better</td>
<td>Same</td>
<td></td>
</tr>
<tr>
<td>Management Design &amp; Planning</td>
<td>Better</td>
<td>Better</td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>Management Control &amp; Monitoring</td>
<td>Better</td>
<td>Same</td>
<td>Better</td>
<td></td>
</tr>
</tbody>
</table>

• **Quantification**: Presence/Absence of Forecasting and Supply Planning process features.

• **Management Design & Planning**: Presence/Absence of Supply chain intervention design and Supply Chain Coordination & Planning process features.

• **Management Control & Monitoring**: Presence/Absence of performance measuring and supervision process features.
Results: Performance

The stockout rate fell for all product groups:

Average across commodities:

95% Confidence Interval
The **stockout duration** also fell:

**Results: Performance**

Average across commodities:

- **Baseline**: 24% (95% Confidence Interval)
- **Round 1**: 15%
Levels of appropriate and high inventory were similar between baseline and round 1:
Expiry rates fell at SDPs, rose slightly for central and zonal

Change in expiry rate, baseline versus round 1

SDPs: 0.1 – 0.4%

Central and zonal: 0.06%
RESULTS: COST, COST-EFFECTIVENESS, AND COST-BENEFIT
The upgraded system more costly, but also more effective and more efficient.

**Total Annual Cost**
- Round 1: $63m
- Baseline: $59m

**Value of Handled Commodities**
- Round 1: $251m
- Baseline: $208m

**Supply Chain Performance**
- Round 1: 77%
- Baseline: 68%

**Cost per value of commodities**
- Baseline: 28%
- Round 1: 25%

**Cost per value of commodities, adjusted for performance**
- Baseline: 42%
- Round 1: 31%
Cost-benefit analyses compares investment cost to system savings

• Investment costs
  – Start up cost for eLMIS and LMU
  – Yearly operating costs for eLMIS and LMU

• Ways that enhancements could generate system savings
  – Reduced cost of purchased drugs
  – Reduction in value of expired products
  – Absorption of staff and supervision costs
**Total start-up cost: $US 2.3 m**

- Investment costs for management upgrades:
  - Upgrades: $1,768,395
  - Existing Training and Supervision: $1,064,282
  - Design: $698,110
  - Project Implementation and Management: $533,758
  - Office space, equipment, supplies, utilities for LMU: $1,064,282
  - Development and Rollout: $533,758

**Estimated year 1 cost: $US 2.9m**

- Estimated Year 1 costs:
  - Office space, equipment, supplies, utilities for LMU: $74,072
  - Vehicles, transport equipment, etc.: $91,687
  - Additional Training and Supervision: $264,322
  - Existing Training and Supervision: $141,750
  - Additional Staffing: $1,064,282
  - Existing Staffing: $698,110
  - Project Implementation and Management: $141,750
  - Design: $533,758
Cost savings due to improved system efficiencies are projected to grow over time.

- **Year 1**: $1.5 million
- **Year 2**: $2.0 million
- **Year 3**: $2.5 million
- **Year 4**: $3.0 million
- **Year 5**: $3.5 million

**Range of savings**
- **Total savings - medium**
- **Total savings - low**
- **Total savings -- high**

**Annual savings (US million)**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.5</td>
<td>$2.0</td>
<td>$2.5</td>
<td>$3.0</td>
<td>$3.5</td>
</tr>
</tbody>
</table>
Cost Benefit Analysis

Global health Supply Chains. Dakar Senegal 2015

5-year net present value = -$2.0 million
5-year simple return on investment = -10%

Net annual savings, $U.S. millions

5-year net present value = -$2.0 million
5-year simple return on investment = -10%
DISCUSSION
Discussion 1: Supply Chain Performance

- The upgrades had a positive impact on key supply outcomes, especially stockout rates.
- Similarly, stockout duration also fell.
- The decrease in stockouts is happening for the “right” reasons.
- Moreover, the upgrades also reduced overall expiry rates.
- Time series analysis appears to support these positive findings.
What is also notable is that these improvements—however modest—happened during a period in which the supply chain continued to confront many challenges.

Moreover, we are measuring the impact of upgrades that are complex, and still relatively new. The full impact of these upgrades is likely still to be felt.
Discussion 3: cost and efficiency

- The upgraded system costs more but also is more efficient.
- The upgrades also appear to have generated significant savings to the government.
Discussion 4: What can we glean from the other findings that might explain these results?

- District pharmacy staff were very positive on the upgrades.
- Central level MOHSW staff also were positive.
- Other central level stakeholders, especially at the development partners and implementing agencies, expressed reservations.
Discussion 5: What can we glean from the other findings that might explain these results?

• Data use indicators improved across a range of dimensions.
• Meanwhile, results from the comparison of reporting was ambiguous.
• There was little movement in some management practice indicators between baseline and round 1.
• On the other hand, some categories of management practice saw broad improvements.
• In sum, the explanation for the positive results is not simple.
Conclusions

• The upgrades generated improvement in key supply chain outcome indicators
• The upgrades—while not cheap—generated greater system efficiency and some savings.
• Additional measurements at 2 years and beyond would provide even greater insight into impact.