Mitigating supply chain challenges through the application of a new, sequential assessment tool - MIAAF –developed based on a case study of a pharmaceutical supply chain.

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Introduction

• Motivation and Context: Health Commodities in Ethiopia
• Supply Chain Challenges
• Supply Chain Visibility
• Solutions that fit Ethiopia — Case Study Research
• MIAAF-tool
• Conclusions
Motivation and Context

- Working as a supply chain pharmacist within EPHCSS. Discovered:
  - Often health commodities were available BUT patients did not receive them!
  - Repeated episodes of Counterfeit and sub-standard health commodities
  - CRITICAL ISSUE: Logistics and Supply Chain Challenges!

Supply Network – key figures
- 1189 Pharmaceutical product groups
- 877 Suppliers
- 258 Importers/wholesalers
- 11 Regional hubs (red dots)
- 7 Sub hubs (blue dots)
- 3000+ Health facilities
- Millions End users

- Research on SC Challenges as part of Master of Science studies in Logistics
  - Field studies in Ethiopia (2 months) + extensive review of existing research
  - Thesis: Improving visibility along the pharmaceutical supply chain + ongoing research w/ Assoc. Prof. Jæger
Supply Chain Challenges

• Frequent **stock-outs** (at health facilities, hubs and central level)
• **Counterfeit products** within the legitimate supply chain
• **Critical:** Stock out of **tuberculosis** laboratory reagents associated with weak tuberculosis diagnostic triggered reluctance of health personnel at all levels not to make ordinary product requests

• Product **under-/overstocking**
• Frequent **emergency orders** of drugs
• Significant **variation in availability** of key medicines
• **Poor supply performance** of importers in terms of **order lead time** (Suppliers – PFSA)
• **Poor order fill rate** (partial deliveries of correct products, PFSA –HF’s)
• **Sub-standard products**
• **Recalls:** Hectic and manually demanding tracing system

Sources: Own studies and MoH 2015, Berhanemeskel 2014, Shewarega et al. 2015, Sinishaw et al. 2015, MoH 2015, Sahle et al. 2012, Suleman et al. 2014
Supply chain challenges e.g.

- Our analysis shows, one way or the other, the supply challenges are a direct result of poor visibility or decision making made on inaccurate/out-of-date data.

**Example**

Blue bars: Insulin injection stock status at different hubs at an instant time in 2016. Some hubs are overstock while others are stock-out.

- It’s not the lack of commodities, the problem is that they are stocked in one place and not in another place,....
Solutions that fit Ethiopia – Case Study Research

- **Goal:** Recommend how to mitigate the SC challenges

- Searched for **solutions that fit Ethiopia with respect to**
  - Financial budget (cost)
  - Infrastructure (electricity access, Internet connection, telecom services)
  - Organizational commitment (actors willingness, technical capability & skills power, Government objectives)
  - System type (Health supply chain)
  - Specific system factors (nature of suppliers, system structure, volume of transaction, operational factors)

- **Case study (MIAAF)**
  - Map existing processes
  - Identify challenges & classify them
  - Aspects navigation through which the challenges could be mitigated
  - Approaches for recommendations that boost the aspect
  - Fitness assessment of the approach
Map existing processes, Identify challenges & classify them

• Find broken processes
• Searching for symptoms/challenges
• Three categories (each require different solutions):
  
  ❖ **Inventory Management, IM:** Factors for frequent stock-outs and inventory overstock
    ❖ E.g. Demand (collection, analysis, evaluation, aggregation), Quantification, Order processing, Supply quantification and rationing
  
  ❖ **Counterfeit products, CO:** Processes being gateways for counterfeit products
    ❖ E.g. during selection of suppliers at central level, during delivery by manufacturers, recieve/delivery to lower tiers
  
  ❖ **Traceability, Tr:** Process points involved during a recall, points of interest for tracking activities
    ❖ E.g. Point of exit from manufacturer(means of registration), GRV/HCMIS/Bincard recording during recieve
Aspects navigation for mitigating the challenges

• I.e. What scientific knowledge or theory to use?

• E.g. Visibility, VMI, Lean, JIT

• Supply chain visibility selected since analysis the supply challenges are a direct result of poor visibility

McInctire 2014, caridi et al. 2010a., Zhao et al.2002., Tsukishima and Onari 2009
Approaches to boost the visibility aspect. **Recommendations:**

1. **GS1 data matrix unique identification**
   - The inner medicine stripes—each one of them will have a unique randomly generated numeric code and labeling (primary packaging). This is the code to be messaged (SMS) by the user.
   - E.G. 100 strips (10 tabs) of amoxicillin will have their own unique number.
   - The outer box package will have one GS1 label (Case and multi-pack labeling).
   - This is the code to be scanned by pharmaceutical importer/wholesaler/pharmacies at the time of receive.
   - E.G. a Box of 1000 tabs (100 strips x 10 tabs) of amoxicillin will have one outer GS1 code.

2. **Authentication systems**
   - A data matrix code package marking

3. **Real-time Inventory Dashboard**
   - HCMIS
   - Pharmaceutical Importer (PFSA Main Hub)
   - Pharmaceutical Wholesaler (Regional Hubs)
   - Health Institutions
   - Pharmaceutical Manufacturers

**Figure 23:** GS1 data matrix code package marking

**Figure 25:** Inventory dashboard
... Approaches to boost the visibility aspect

• Why GS1?
  ✓ Global standard
  ✓ 80% of the pharmaceutical companies, supplying to EPHCSS, are international suppliers
  ✓ Many pharmaceutical manufacturing companies all over the world are already printing GS1
  ✓ 2 neighbouring and 11 other same economic status African countries have established it
  ✓ Nonprofit (a very good incentive for the rest 20% locally based pharmaceutical manufacturers)

• Why Data matrix?
  ✓ Same size with barcode but with lots of information density (Batch, Mfg.date, Exp.Date, Prdct,...)
  ✓ Already the good standard for pharmaceutical products
  ✓ Financial aspect (Cost) – barcodes are largely low-price from an RFID or other tagging techniques.
  ✓ Already built structure of the EPHCSS (Not to think of VMI for example)

• Why unique identification?
  ✓ To target counterfeit products

• Why database authentication?
  ✓ As part of enabling easy tracking and tracing

• Why Real-time Inventory Dashboard?
  ✓ Link Scanning with current inventory management system (HCMIS)
Fitness assessment of the approach

- Features of an approach are only valuable to the **degree that they fit** into the **targeted business decisions**

- Only **visualization of meta-data** can do nothing if those features don’t help in answering company business decisions

- Purpose of SCVS (Supply chain visibility scorecard) –
  - To measure –Fitness-the degree to which an approach meets the targeted business needs of the decision making processes and the output offered by the approach
  - **Sensitivity** –How well the approach captures the supply chain data
  - **Accessibility** –How integrated the approach makes its data model (a business user may start from any point and find the data they need )
  - **Intelligence** –The effectiveness of the routines used to process data and render it into relevant information.
  - **Decision relevance** -How well the visibility solution integrates into business decisions.
Fitness assessment of the approach. Supply chain visibility scorecard

### Visibility Solution Name: **GS1 data matrix barcoding + GDSN + Inventory Dashboard**

<table>
<thead>
<tr>
<th>Targeted Business Decisions which visibility solution should support</th>
<th>Sensitivity</th>
<th>Accessibility</th>
<th>Intelligence</th>
<th>Decision Relevance</th>
<th>Fit %</th>
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<tbody>
<tr>
<td><strong>Inventory Management</strong> (IM)</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>20.8%</td>
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<tr>
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<td>3</td>
<td>6</td>
<td>1</td>
<td>20.8%</td>
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<tr>
<td>Analysis/Evaluation/Aggregation of APR</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>20.8%</td>
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<tr>
<td>Final Analysis (VEN/ABC analysis)</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
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<tr>
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<td>3</td>
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<tr>
<td>Stock request process</td>
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<td>3</td>
<td>4</td>
<td>2</td>
<td>50%</td>
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<tr>
<td><strong>Customer-centric (CO)</strong></td>
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<tr>
<td>Selection of supplier</td>
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<tr>
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<tr>
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<tr>
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<td>Actors receive inform record</td>
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**Estimated Total Cost:** 10,000 Euro

Overall fit %: 35.38%

### Visibility Solution Name: **GS1 RFID with passive tag + EPCTS + Inventory Dashboard**

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**Estimated Total Cost:** 100,000 Euro

Overall fit %: 38.52%
Lessons Learned

- Very positive feedback from PFSA staff, particularly for the speed and accuracy by which data was collected.
- Quality, size, and placement of the barcodes on the products noted as critical factors.
- 2D data barcodes are more difficult for the mobile application compared to 1D barcodes.
- Tracking secondary-level packages at the central warehouse was considered challenging due to scale.
- Tracking at container level may provide more immediate benefits.
- A dedicated hardware scanner (rather than a Smartphone) should be considered for future work.
- Overall, this pilot project has promising results to inform broader traceability efforts in Ethiopia’s public health sector.
Conclusions

• Supply Chain Challenges are critical to solve for the supply of Health Commodities in Ethiopia

• Our proposal: Supply Chain Visibility can help to mitigate the challenges by:
  • Proposed Solutions that fit Ethiopia
  • GS1 data matrix unique identification
  • End-user authentication system
  • Real-time Inventory Dashboard

• MIAAF-tool: The method can be used as a tool to approach Supply Chain Challenges
Thank you!
Tusen takk!
Հարցում եմ!