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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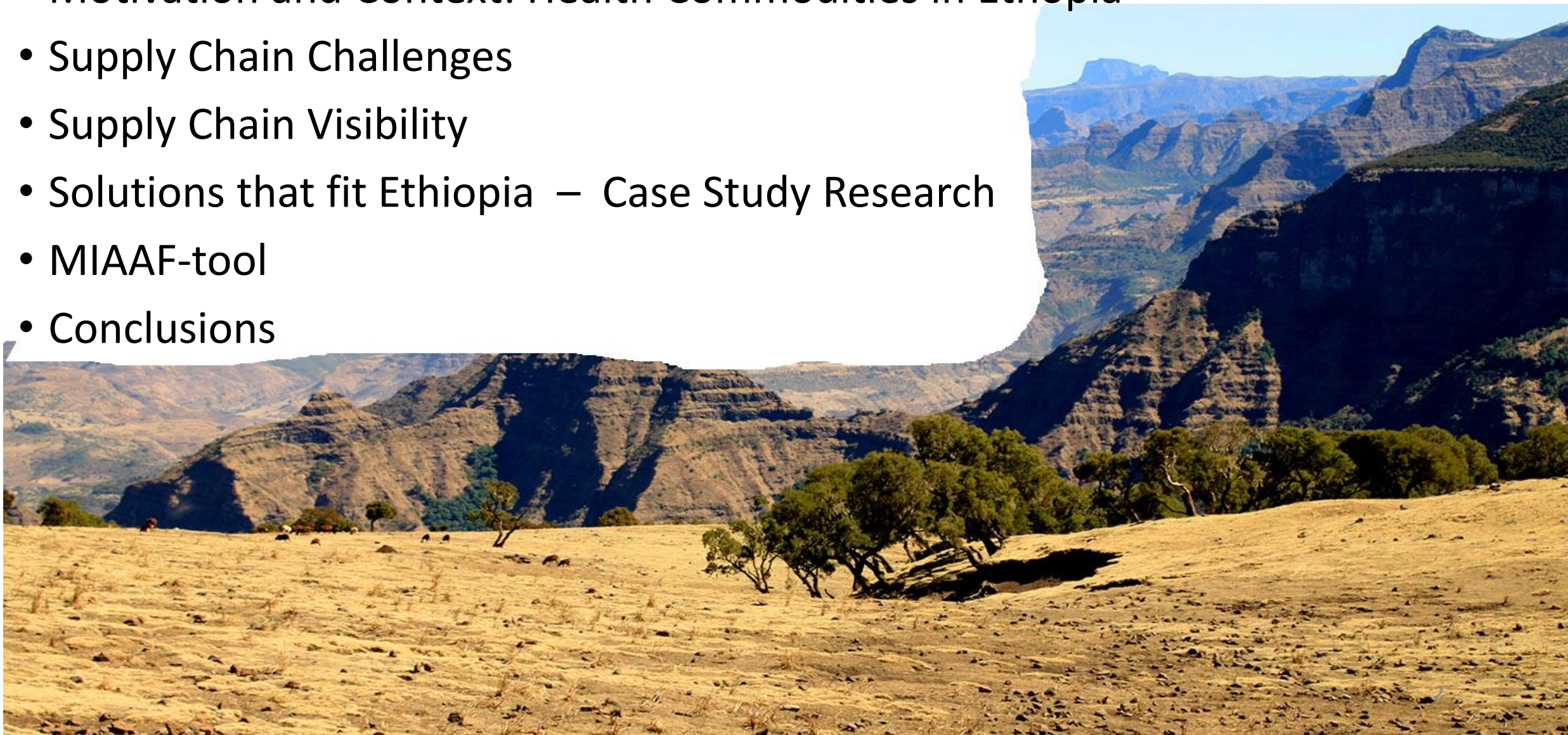
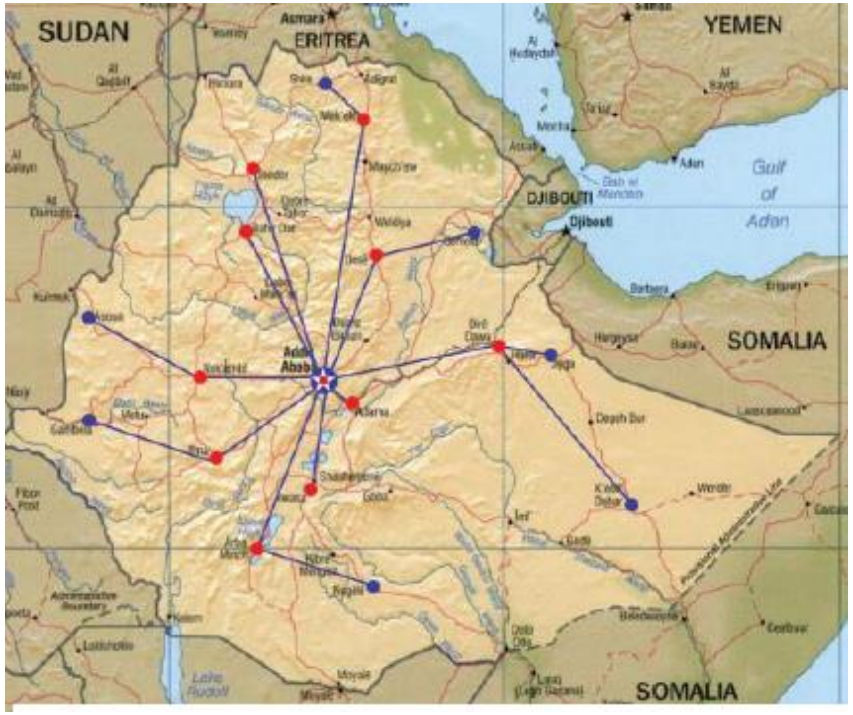
Introduction

- Motivation and Context: Health Commodities in Ethopia
- 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

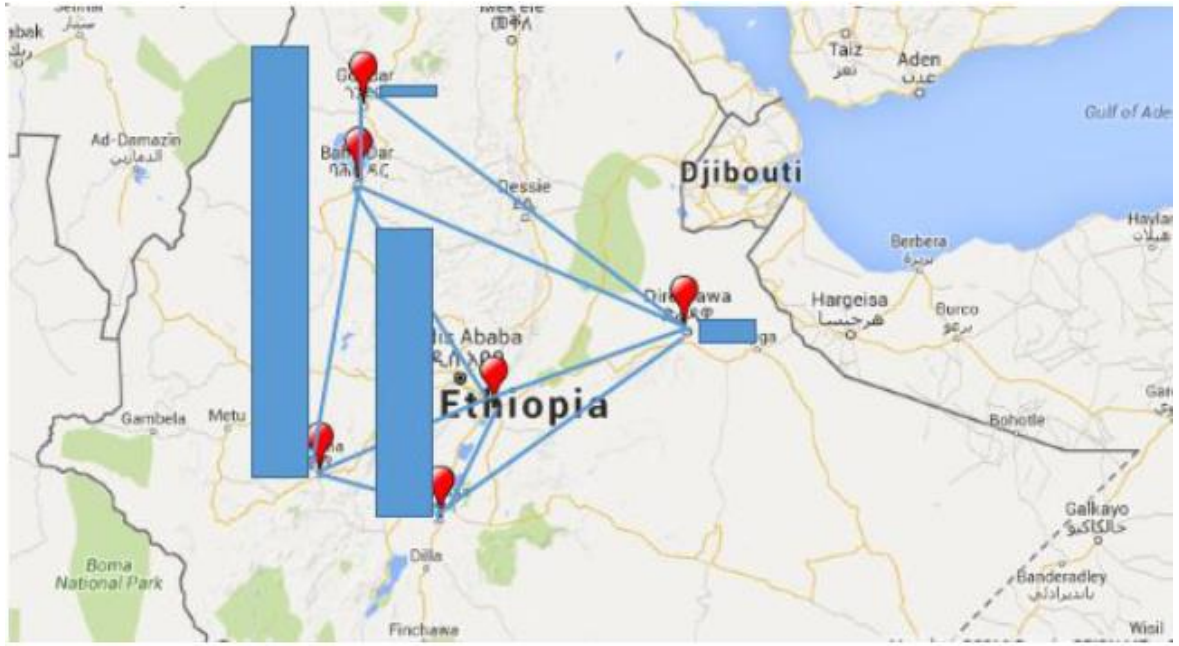
- Frequent **stock-outs** (at health facilities, hubs and central level)
- **Counterfeit products** within the legitimate supply chain
- **Critical:** Stock out of **tuberculosis** laboratory reagents associated with weak tuberculosis diagnostic triggered reluctance of health personnel at all levels 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:** Reccomend 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)**
  - **M**ap existing processes
  - **I**dentify challenges & classify them
  - **A**spects navigation through which the challenges could be mitigated
  - **A**pproaches for recommendations that boost the aspect
  - **F**itness 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 knowlege 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:

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 (10tabs) of amoxicillin will have their own unique number

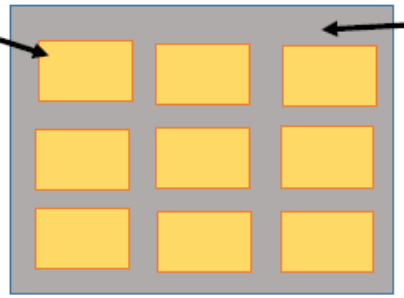
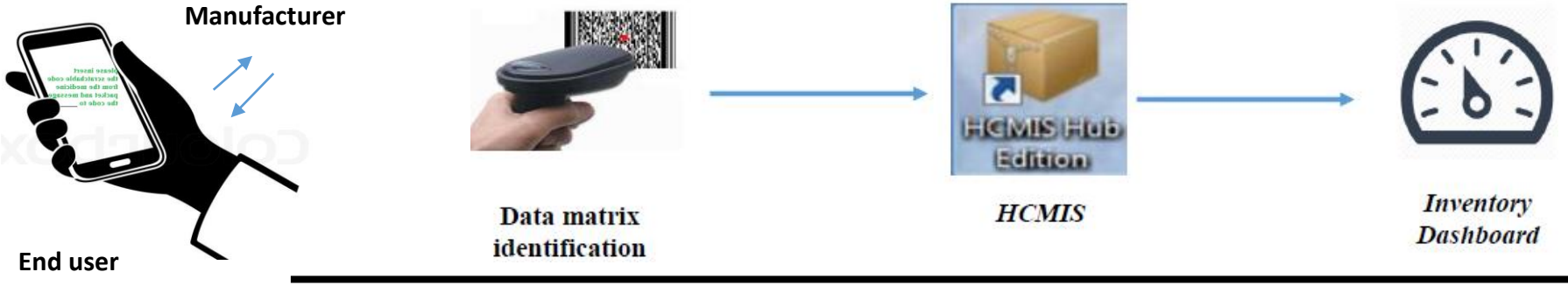


Figure 23: GS1 data matrix code package marking

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 (100stripes x10tabs) of amoxicillin will have one outer GS1 code

(1)

GS1 data matrix unique identification



(2)

Authentication systems

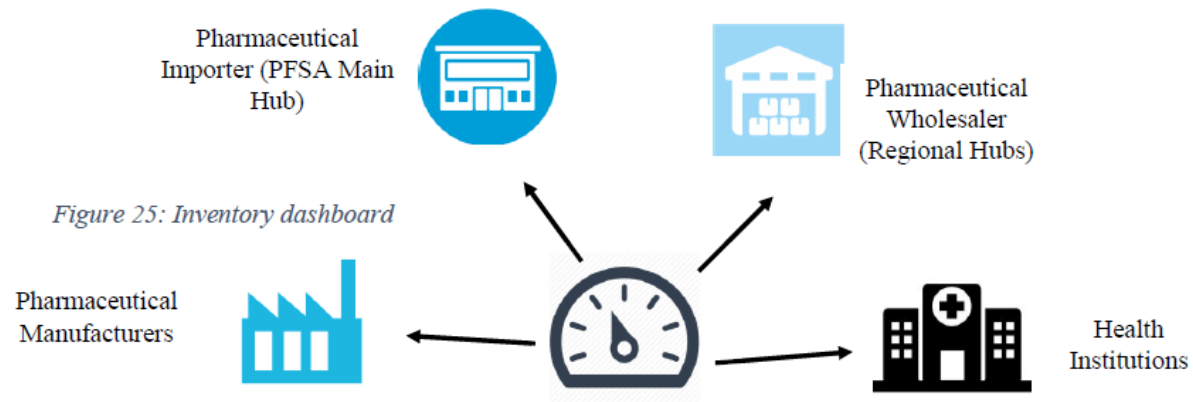


Figure 25: Inventory dashboard

(3)

Real-time 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 neigbouring 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**

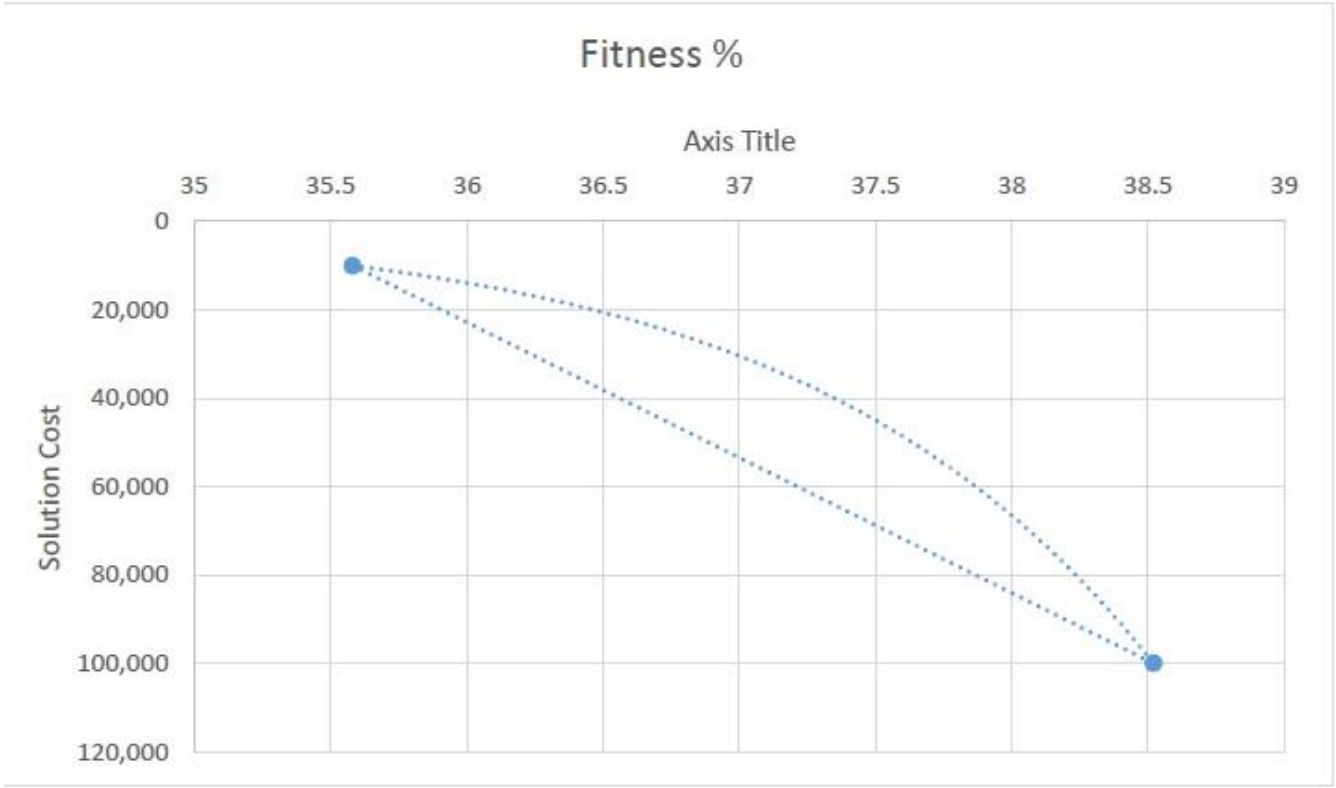
Targeted **Business Decisions** which the visibility solution should support	Sensitivity	Accessibility	Intelligence	Decision Relevance	Fit %
Inventory Management (IM)					
Annual Demand Quantification	1	3	0	1	20.8%
Analysis/Evaluation/Aggregation of APR	1	3	0	1	20.8%
Final Analysis (VEN/ABC analysis)	1	3	0	1	20.8%
Quantification/Rationing	2	3	0	1	25%
Analysis/Rationing	2	3	0	1	25%
Stock request process	3	3	4	2	50%
Counterfeit detection (CO)					
Selection of supplier	0				0%
Delivery and Receive authorization	4	4	3	5	66.6 %
Tracing (Tr)	4	4	3	2	54.1 %
Manufacturer delivery inform. Record					
Actors receive inform. Record					
Actors issue inform. Record					

Estimated Total Cost: __10,000 Euro[3]____ Overall fit %: ___35.38%____

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

Targeted **Business Decisions** which the visibility solution should support	Sensitivity	Accessibility	Intelligence	Decision Relevance	Fit %
Inventory Management (IM)					
Annual Demand Quantification	1	3	0	1	20.8%
Analysis/Evaluation/Aggregation of APR	1	3	0	1	20.8%
Final Analysis (VEN/ABC analysis)	1	3	0	1	20.8%
Quantification/Rationing	2	3	0	1	25%
Analysis/Rationing	2	3	0	1	25%
Stock request process	3	3	4	2	50%
Counterfeit detection (CO)					
Selection of supplier	0				0%
Delivery and Receive authorization	4	6	4	5	79.16%
Tracing (Tr)	4	6	4	2	66.67%
Manufacturer delivery inform. Record					
Actors receive inform. Record					
Actors issue inform. Record					

Estimated Total Cost: ___100,000Euro[1]____ Overall fit %: ____38.52 %_____



Promising example of further studies (by others): RFID Traceability study by USAID /GS1

USAID | DELIVER PROJECT
FROM THE AMERICAN PEOPLE

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Brief

Traceability in Ethiopia's Health Sector: Piloting GS1 Barcodes with Global Trade Item Number Serialization to Track Health Commodities from Supplier to Health Facility

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

Ref: http://www.jsi.com/JSIInternet/Inc/Common/_download_pub.cfm?id=18007&lid=3

Conclusions

- **Supply Chain Challenges are critical to solve for the supply of Health Commodities in Ethopia**

- **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 !

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