Quantitatively measuring supply chain visibility - application of a novel approach – along the pharmaceutical supply chain

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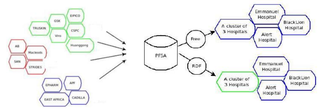
PROJECT SUMMARY

Introduction

- SCV (Supply chain visibility) is "*the awareness of, and control over, specific information related to product orders and physical shipments, including transport and logistics activities, and the statuses and events and milestones that occur prior to and in-transit*" in a supply chain (Heaney, 2013).
- It is rated as ***the most important measure for supply chain performance*** both by business leaders and researchers (McIntire, M. J. 2014).
- Therefore, being able to ***efficiently measure and know the status*** of this SCV in a given pharmaceutical supply chain has a significant value for ***benchmarking or improvement purposes***.

Objective

- Apply a ***novel quantitative approach*** to measure the SCV of the Pharmaceutical Fund and Supply Agency (**PFSA**) central in the Ethiopian Public Health Commodities Supply System (EPHCSS).



Actors:

- 15 pharmaceutical suppliers
- PFSA
- 3 main hospitals as buyer

Major Activities and Findings

- **Hospital activity flow sample. Information flow exchanged** between **Responsible Persons** for a selected study pharmaceuticals

APTS, Hospital activity flow for RDF products				
APTS Activity Flow		Information Flow exchanged	Responsible Person	Forms Used
Client/patient arrives with a prescription				
Professional Checks the validity and legitimacy of the prescription		Patient personal Information; Name, Age and Address Patient Diagnosis Patient Disease Prescription Information Drug name, ROA, Strength Physician Information	Evaluator(Pharmacist by Profession)	Patient Catalog Book
	If the Drug is stock-out or Unavailable	Stock out	Evaluator Coordinator Store Man DSM (Drug Supply M.)	Personal Note HFRI HMIC RRF

- Information Flow exchanged are **categorized** as one of the kind: **master data (M), transaction/events (T), status information (S) and operational data (OD)**

Transaction/Events: (12)
When purchase is happening
- Purchase order generated
- Purchase order sent
- Payment initiated
- Payment Completed
- Transaction Completed
- Product is issued from Special Pharmacy
- Product is Issued from Main pharmacy

Master Data: (7)
- Patient/Client Personal Information
  - ✓ Name, Age and Address
- Patient/Client Financial Information
  - ✓ Free Patient/client status
  - ✓ Cash paying Client
  - ✓ Credit Client
- Patient Diagnosis
  - ✓ Patient VS's by date and time

Status Information (6)
Instant standing status of a drug
- Main Pharmacy Stock out
- Special Pharmacy Stock out
- Warehouse Stock out
- Main Pharmacy Stock level

Operational Plans (2)
- Near expiry transfer plan
- Expired and damaged items disposal plan

- **How much** information (**quantity**) and **how well** (**accuracy** and **freshness**) of the Information flow exchanged the focal company accesses is graded.
- **Mathematical calculations** followed to reach on partial/global visibility index

Minimum score=1, Maximum score=4

	Transaction/Events	*Status information*	*Master data*	*Operational data*
Quantity	3	4	2	4
Accuracy	3	2	2	2
Freshness	1	1	1	2

Node_Visibility_Quantity/Accuracy/Freshness of the focal company =

$$\sqrt[4]{\left(\begin{array}{l}\text{Quantity/Accuracy/Freshness accessed of status information} \\ \text{x Quantity/Accuracy/Freshness accessed of } \frac{\text{Transaction}}{\text{events}} \text{ information} \\ \text{x Quantity/Accuracy/Freshness accessed of Master Data} \\ \text{x Quantity/Accuracy/Freshness accessed of operational data}\end{array}\right)}$$

Overall_Visibility_of_Status /transaction/master/operational information of the focal company=

$$\sqrt[3]{\left(\begin{array}{l}\text{Quantity accessed of Status/transaction/master/operational information} \\ \text{x Accuracy of status/transaction/master/operational information} \\ \text{x Freshness of status/transaction/master/operational information}\end{array}\right)}$$

SUMMARIZE MAIN QUESTIONS AND RESULTS HERE WITH FIGURES ETC

Approaches

Quantitiative model developed by Caridi et al. (2010).

- The tool guides to assess the level of SCV quantitatively, from the angle of **defining the most important features of information flows** e.g. **quantity, accuracy**, or **freshness** along actors within a supply chain.
- The model suggests **structured approaches** to reaching the **final goal:**

1. Identification of key information segments in a supply chain

2. Classifying information as:

Master data: Features of products

Transactions/Events: To be communicated when an event takes place e.g. order confirmation, order modification

Operational data: About the company's future plans (e.g. distribution plan, production plan,

Status information: Describes the status of some resources or of a process (e.g. order status, stock level).

3. Grading of the information flow exchanged

Quantity: How much

Score	Description
1	The focal company has access to none or little (less than 25 per cent) of the information within the analysed category (transactions/events, status information, master data and operational plans)
2	The focal company has partial access (between 25 and 50 per cent) to the information within the analysed category (transactions/events, status information, master data and operational plans)
3	The focal company has access to a fairly good amount (between 50 and 75 per cent) of the information within the analysed category (transactions/events, status information, master data and operational plans)
4	The focal company has access to a large part (more than 75 per cent) of the information within the analysed category (transactions/events, status information, master data and operational plans)

Quality: Accuracy

Score	Description
1	The accuracy of the exchanged information within the analysed category (transactions/ events, status information, master data and operational plans) is usually very low and unsatisfactory
2	The accuracy of the exchanged information within the analysed category (transactions/ events, status information, master data and operational plans) is usually satisfactory, but situations in which the information is incorrect are not uncommon
3	The accuracy of the exchanged information within the analysed category (transactions/ events, status information, master data and operational plans) is usually satisfactory, and the information is incorrect only in a few situations
4	The accuracy of the exchanged information within the analysed category (transactions/ events, status information, master data and operational plans) is always satisfactory (very good accuracy)

Quality: Freshness

Score	Transactions/events	Status information	Master data	Operational plans
1	Less than once a day	Unsatisfactory	Monthly or less than once a month	Not visible at all
2	Daily frequency	Information is updated only when the node is asked to provide data	Weekly or fortnightly frequency	Information is updated only when the node is asked to provide data
3	Few hours of delay	In some cases information is updated only when the node is asked to provide data	Daily frequency	Plans are visible in real time, but changes are visible only when the node is asked to provide data
4	Real time	Real time	Real time	Plans and their changes are visible in real time

4. Node partial and global visibility estimation considering parameters

Localization: The distance of each node from the supply chain leader- **locaweight**
Significance weight in terms of the value of goods supplied **wsigk.** Tthe more the focal company buys from the supplier, the more interested the focal company should be in having visibility of this supplier.
Criticality: the impact on profits and the supply risk, **critweight**

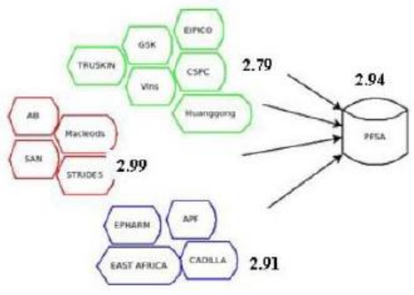
$$\text{wloc}_k = \begin{cases} 1 & \text{for first-tier suppliers} \\ 1 - \frac{\sum_{n \in I_k} AV_n}{S_{tot,PC}} & \text{for suppliers belonging to tier } z, \text{ with } z \geq 2 \end{cases}$$

Results

Inbound Supply chain

Program/RDF

- The focal company has a better partial visibility (2.99 of 4) with regard to **international suppliers of program pharmaceuticals** than with the **local suppliers** (2.91 of 4) and **international suppliers** (2.79 of 4) of **RDF** (purchase) pharmaceuticals.
- More than **75 % of all the information flow** within the inbound suppliers is accessed by the focal company
- The **accuracy** of the accessed information is of intermediate score (3/4) and **the freshness** is indeed very poor (1.6/4).
- **Operational data** are those information flows accessed with better **accuracy** and **freshness** while transaction/events information flows with least **freshness** score.



Oubound supply chain

- Similar results were recorded in the outbound portion
- Information flow within hospitals for the Program (free) pharmaceuticals supply line, is better accessed (more than 75% accessed)
- But with moderate quality; **accuracy** (2.44 of 4) and **freshness** (1.56 of 4) than the RDF (purchase) supply line; Accessibility (3.13 of 4), **accuracy** (2.21 of 4) and **freshness** (1.61 of 4).

RDF =2.24												
T		S		MD		OD						
2.06		1.99		1.58		2.51						
Quantity				Accuracy				Freshness				
3.13				2.21				1.18				
T	S	MD	OD	T	S	MD	OD	T	S	MD	OD	
3	4	2	4	3	2	2	2	1	1	1	2	

Program =2.79												
T		S		MD		OD						
2.28		3.29		1.99		2.51						
Quantity				Accuracy				Freshness				
4.0				2.44				1.56				
T	S	MD	OD	T	S	MD	OD	T	S	MD	OD	
4	4	4	4	3	3	2	2	1	3	1	2	

Data collection

Case study – data collection

1. Discussions and interviews(based on semi-structured questionnaires) with local pharmaceutical manufacturing company representatives; *Julphar, Cadilla, APF, Epharm*	Key 3; Needed for the approach- to build the **product process flow** within pharmaceutical suppliers Key 4; From that to find out what **information the international suppliers exchange** on those products they supply to PFSA	February 4- March 1
2. Email communications and website material access for international suppliers: *Auro bindo Pharma Limited, Macleods ,San ,Strides , Arcolab , GlaxoSmithKline (GSK), Egyptian International EIPICO, Gulf Pharmaceuticals, Huanggang Hyangzhou, Truskin Glove Pvt.Ltd, Vins Biopoducts Ltd, CSPC Zhongnuo Pharmaceutical*		
1. Discussion and interview with PFSA general director		
2. Discussion and interviews with selected hospital pharmacy heads (BLH, Emmanuel, Alert hospital - appointment in person)	Key 5; Needed for the approach- to build the **product process flow** and **activity flows** within health institutions Key 6; From that to find out what **information the institutions exchange** on those products they are supplied by PFSA	
1. Discussion and semi-structured interviews with PFSA FCB unit (Directorate director, coordinator, officers- appointment in person)	Key 7; Needed for the approach – to mark **how** and **what** or **which** of the information the international suppliers/health institutions exchange does this core company access/share	
1. Data Analysis of financial documents(yearly purchase amounts, hub consumption reports)	Key 8; Needed for the approach- to select and grade those pharmaceuticals focused for this research and to grade the suppliers significance with respect to the hub	

Research limitations

- No similar quantitative visibility studies conducted within the study country or other pharmaceutical systems so that benchmarking of the results might not become practical for now.
- Grouping of information flow types into their respective categories was a bit ambiguous.

Practical implications

- Responsible stakeholders and the focal company can use the results to target areas which need visibility improvement with regard to their strategic objectives.
- Our recommendation: Those information segments which could influence key business processes (e.g. Status, events, operational etc.) shall be accessed as accurate and as fresh as possible.

CONCLUSIONS, CONTRIBUTIONS

- Able to implement the visibility tool on the pharmaceutical supply chain
- Able to quantitatively tell how poor or good the supply chain visibility is from the perspective of **quantity and quality** of information exchange among actors.
- Since results are quantitative, benchmarking and comparison of systems could be appropriate.