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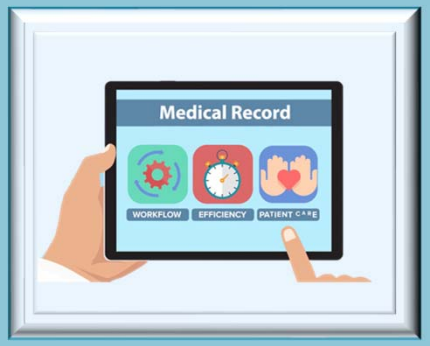
A framework for operational excellence in hospital logistics

Karen Moons
Healthcare Logistics Education and Learning Pathway - HELP

Agenda

Introduction



Healthcare logistics performance management framework

Main insights

Introduction

Study: Hospitals can save $9.9M by improving their supply chains

Sept. 20, 2017

Onze ziekenhuizen draaien steeds meer verlies

03/11/2018 om 09:30 door edm | Bron: De Tijd

Deloitte.

2016 Global health care outlook
Battling costs while improving care

Surgeries often lead to huge amount of discarded and unused supplies

by Ron Shinkman | Sep 8, 2016 1:49pm

Hospitals' wasted supplies may contribute to growing costs

by Paige Minemyer | Mar 10, 2017 11:38am

LOGISTICS
How supply chain management can help to control health-care costs

By Bernie Monegain | December 14, 2015 | 08:29 PM

Supply chain issues costly for healthcare, Cardinal Health survey finds

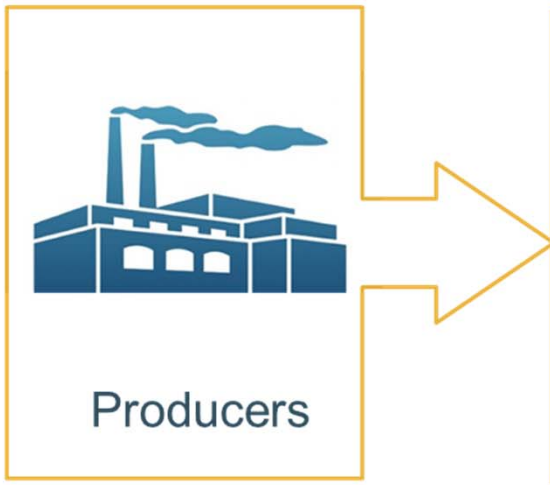
Supply chain is the second largest expense for healthcare providers, accounting for $5 billion in annual waste.

Logistics and Supply Chain Management (SCM)

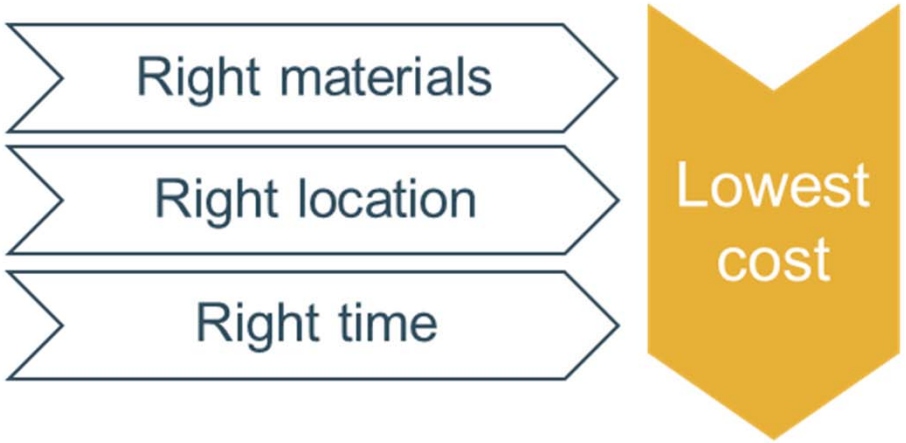
*"Logistics management is that part of SCM that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements" **

* Council of Supply Chain Management Professionals (2016)

Healthcare Logistics = logistics activities provided in a healthcare setting



Healthcare Logistics = Flow of medical goods from producer to patient




Food


Pharmaceuticals


Sterile disposables


Surgical instrument sets


Medical equipment


Patient transportation


Waste/reverse logistics

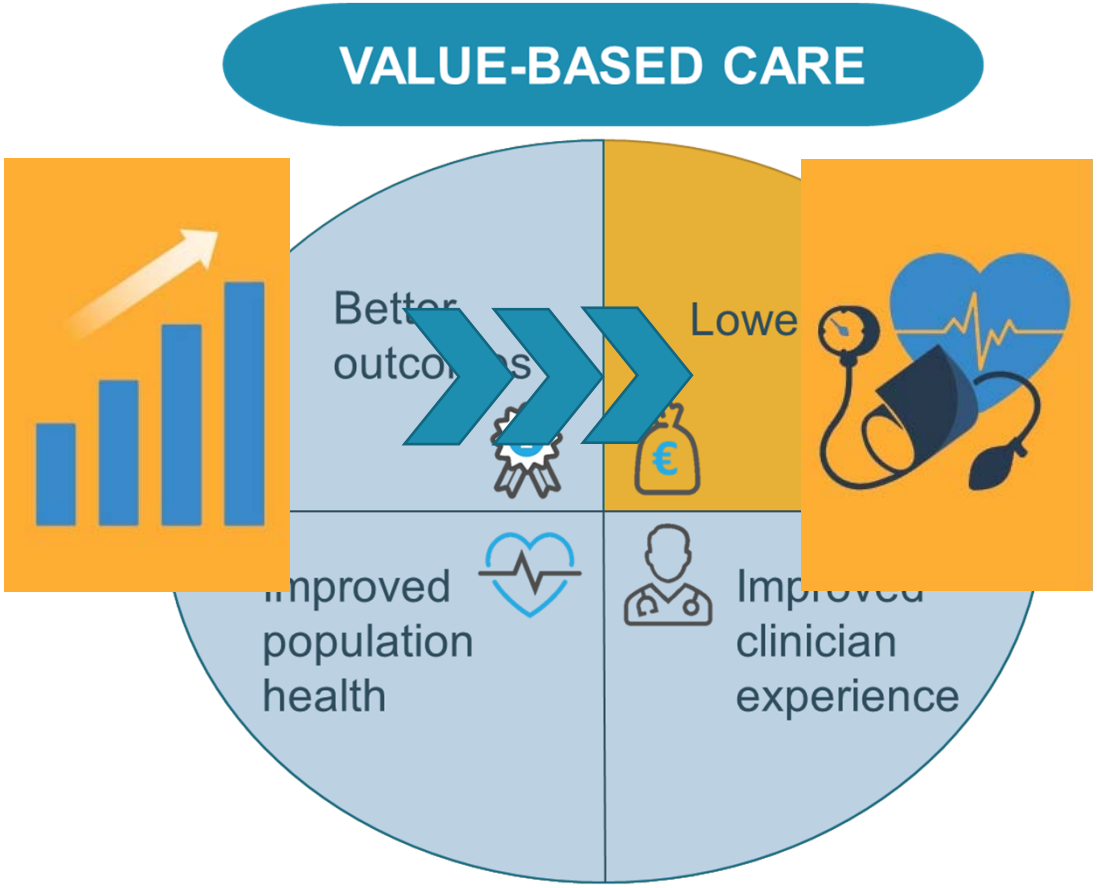
Share of logistics activities in total hospital expenditures*

➔ Great potential for cost reductions

*Jawab, Frichi and Boutahari (2018)

Problem statement

Paradigm shift: volume-based to value-based care



Problem statement

Paradigm shift: volume-based to value-based care

➔ Strive for operational excellence:

*"**Operational excellence** is achieved through the use of best inventory management and distribution systems, combined with continuous supply chain process improvements and better integration with the patient care process"**

Healthcare logistics engineering

* Landry and Beaulieu (2013)

Problem statement

“How are we currently performing?”

Expertise

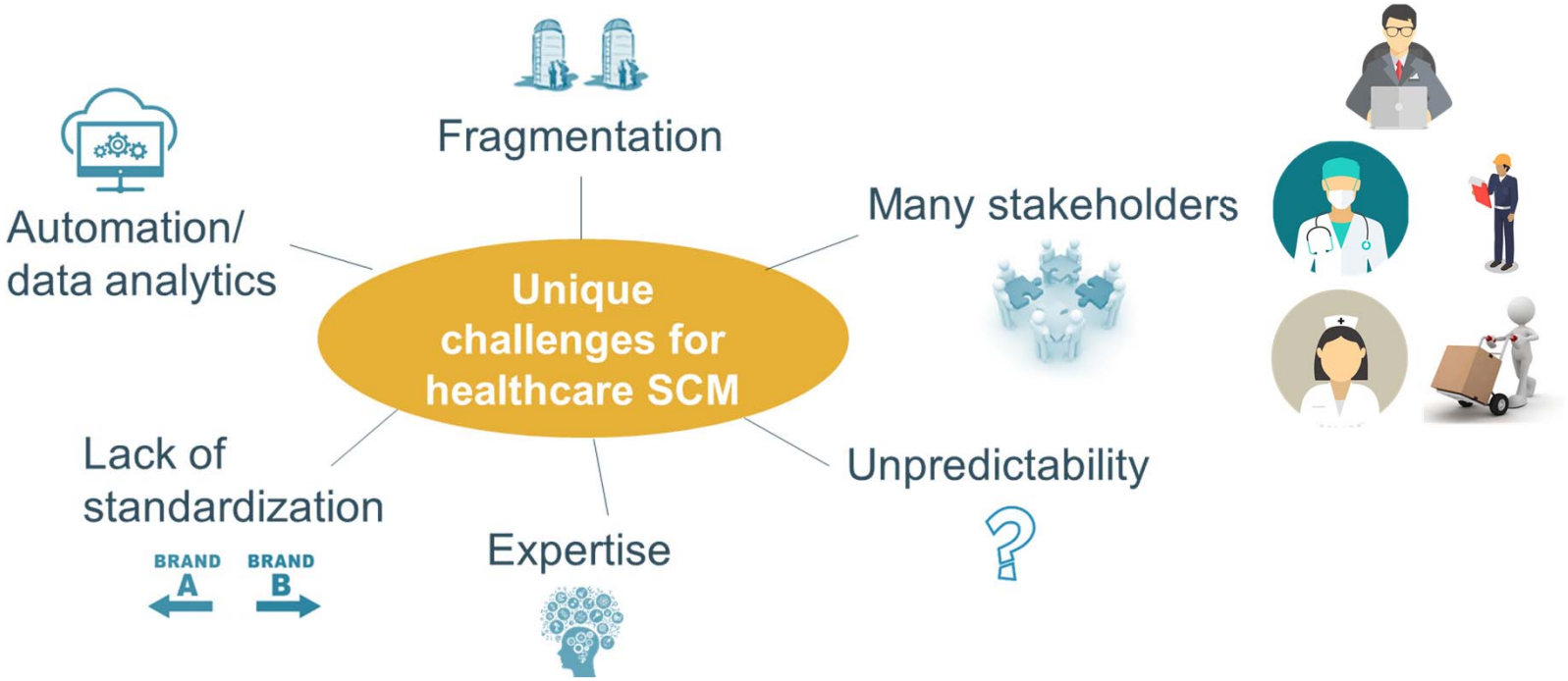
Monitors

Internal hospital supply chain processes

= product and information flows from receiving, replenishing, picking, etc.

<u>The struggle is real:</u>

➔Tailoring SCM techniques to unique charachteristics in healthcare:



Research question

Need for comprehensive approach for adopting SCM techniques: quantify how logistics contribute to healthcare

“How to develop a decision-support framework to guide hospitals in adopting SCM practices to improve performance of the internal hospital supply chain according to the stakeholders’ preferences?”

Healthcare logistics performance management framework

Methodology

Implementation roadmap

Reengineering healthcare logistics flows

❶ Select **indicators** for each process type

Implementation roadmap

Reengineering healthcare logistics flows

❶ Select **indicators** for each process type

❷ Construct **network** structure with **interdependence**

❸ **Prioritizing** KPIs using pairwise comparisons

Implementation roadmap

Reengineering healthcare logistics flows

❶ Select **indicators** for each process type

❷ Construct **network** structure with **interdependence**

❸ **Prioritizing** KPIs using pairwise comparisons

❼ Interpreting the **ILEP index** as outcome from ANP-DES tool

❻ Modelling logistics processes using **simulation**

❺ Defining alternative **scenarios** for **SCM interventions**

❹ Mapping the **As-Is** situation and identifying bottlenecks

Implementation roadmap

Reengineering healthcare logistics flows

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❹ Mapping the **As-Is** situation and identifying bottlenecks

❽ Sharing **information** between **stakeholders** using visual cues

❾ Choosing **best policy** tailored to healthcare setting based on ILEP index

❿ **Benchmarking** and continuous improvement programs

Integration

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1 Select **indicators** for each process

How is the internal hospital supply chain currently performing?

State-of-the-art **Key Performance Indicators** in healthcare logistics

You can't manage what you don't measure

- Multi-dimensional character of supply chain processes in hospitals
- Choose the right indicators
- Traditional logistics KPIs: uniform performance measurement

	Quality				Cost		Time		Productivity		
	Availability (service level, stock-out)	Inventory visibility (on-hand, safety stock)	Criticality of inventory items	Patient safety (delays, errors)	Replenishment time	Clinical staff involvement	Inventory cost	Value of stock, stock wastage	Inventory turnover	Utilization rate	Standardization
Fong et al. [36]	X			X			X			X	X
Supeekit et al. [86]	X			X	X		X	X	X	X	
Carrus et al. [18]				X			X	X	X		X
Hoeur et al. [44]	X	X		X			X				

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2 Construct **network** structure

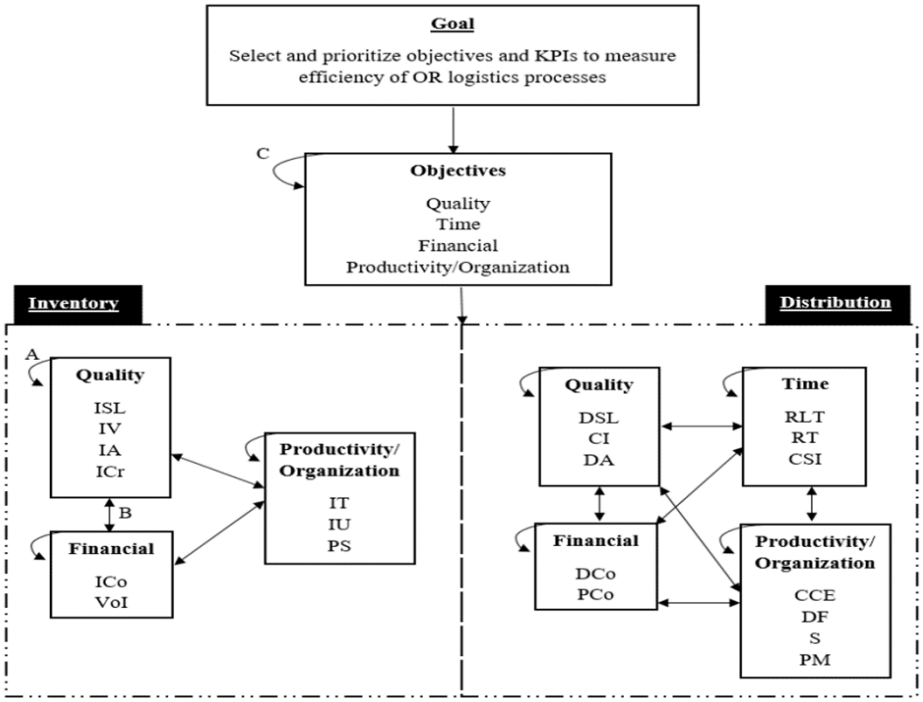
Operational excellence definition?

Analytic Network Process (ANP)

*= a quantitative technique that establishes criteria, assigns weights in terms of importance, and scores each alternative on each criterion to create an overall assessment of value**

Translating the strategic objectives into operational performance indicators

ANP-based prototype



*Marsh et al. (2014)

3 Prioritizing KPIs

ANP-based prototype:

Assign relative weights to KPIs

- Elicit stakeholder preferences using pairwise comparisons
- Single stakeholder perspective

Assess alternatives by trading-off KPIs

- Define synthesized value in multiple dimensions:
  - ❖ Shared goal that unites interests of all stakeholders

Outcome = **best set of KPIs** for operational excellence

Inventory objectives	Weights	Indicators	Weights	Ranking	Cumulative weights
Quality	0.68	Inventory service level	0.289	1	0.289
		Inventory visibility	0.106	5	0.802
		Inventory accuracy	0.123	3	0.576
		Inventory criticality	0.164	2	0.453
Financial	0.06	Inventory cost	0.032	8	0.972
		Value of inventory	0.027	9	1.000
Productivity/ organization	0.26	Inventory turnover	0.120	4	0.696
		Inventory usage	0.075	6	0.877
		Product standardization	0.063	7	0.940
Distribution objectives	**Weights**	**Indicators**	**Weights**	**Ranking**	**Cumulative weights**
Quality	0.32	Delivery accuracy	0.092	5	0.630
		Centralization	0.091	6	0.721
		Distribution service level	0.136	2	0.296
Time	0.15	Replenishment lead time	0.057	8	0.851
		Response time	0.053	9	0.904
		Clinical staff involvement	0.036	10	0.940
Financial	0.06	Distribution cost	0.035	11	0.975
		Personnel cost	0.025	12	1.000
Productivity/ organization	0.48	Case cart efficiency	0.073	7	0.794
		Delivery frequency	0.121	4	0.538
		Process standardization	0.160	1	0.160
		Personnel management	0.121	3	0.417

→ Blueprint for reengineering healthcare logistics flows

4 Mapping the **As-Is** situation

Case study design to support policy decision making and performance measurement

- Problem understanding

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1,900 beds

735,000 consultations/year

65,000 emergencies/year

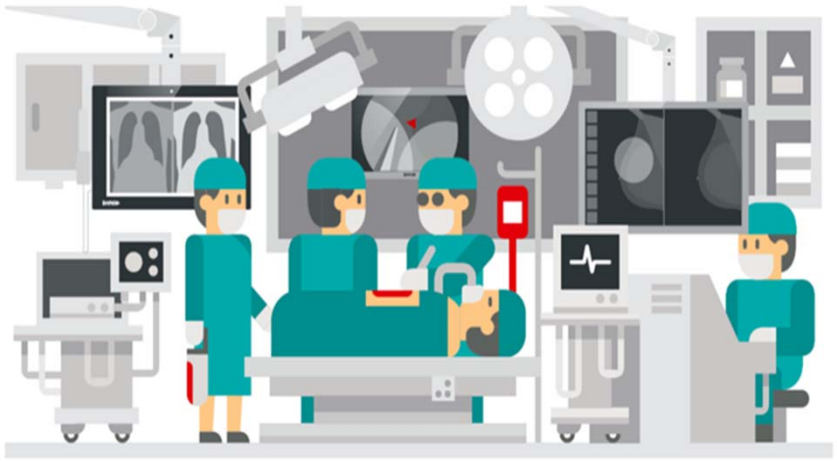
58,000 hospital admissions/year

57,000 surgical procedures/year

9,760 staff members

1,500 physicians

Operating Theatre/Operating Room (OR)



Critical

Guarantee supply availability

Cost driver

Surgical supplies = 40 – 60% of hospital supply expenditures*

Complex

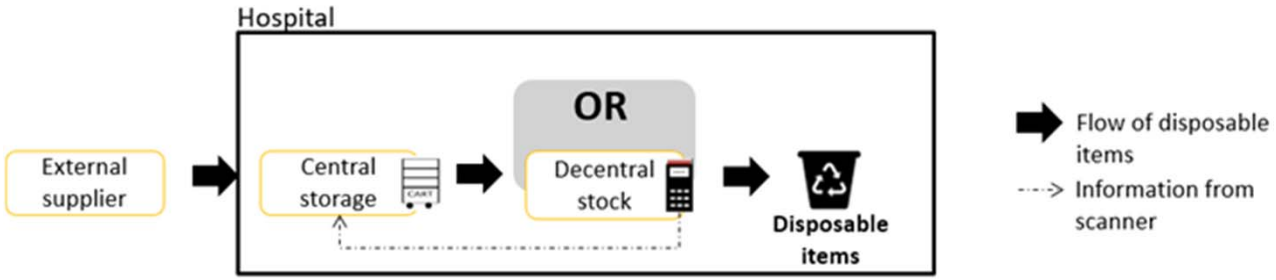
Multiple point-of-care location: streamline inventory and distribution

Waste in current practice: hidden stock, physician preference items, stock duplication, no item tracking, nonstandard distribution methods, unsatisfied personnel

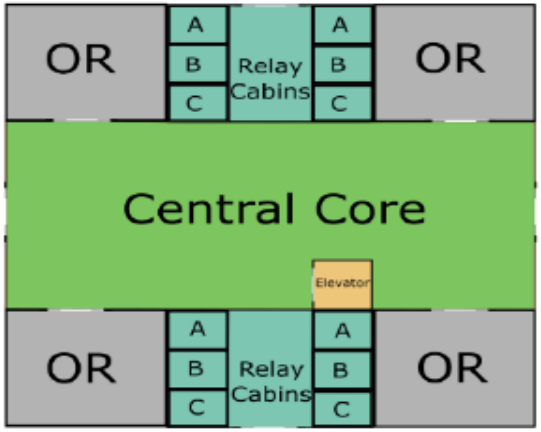
* Weiss et al. (2016)

Case study – Materials replenishment flow at the OR

How to move materials from central storage to decentral storage?



Source: UZ Leuven (2017)



Central storage rooms			
> 2600 SKUs		€910,000	
CSA storage	OT1 storage	CSA storage	OT1 storage
736 SKUs 24688 items	1880 SKUs 33575 items	€75300 3.05 €/item	€834100 24.84 €/item

Decentral stock: 1 cluster			
SKUs		Costs	
Relay cabins	Central core	Relay cabins	Central core
143 SKUs 494 item locations	253 SKUs 271 item locations	€3400 6,88 €/location	€7850 28,96 €/location

Replenish **> 5250** decentral item locations on a daily basis: 80000€

5 Defining SCM **scenarios**

Scenario analysis: identify efficiency improvements by developing logistics policies triggered by most relevant KPIs

- As-Is: baseline scenario
- To-Be: improvement initiatives

Range of SCM interventions

Inventory	Distribution	Other functions
EOQ (s, S) policy RFID enabled 2-bin	Replenishment Case cart system Line Balancing	Vendor management for procurement Forecasting for demand planning Systematic Layout for hospital architecture

Case study – Materials replenishment flow at the OR

Scenarios	*As-Is*
No double stock	✗
Immediate replenishment	✓
Barcode scanner	✗
Consumption data	✗

Replenishment policies:

- **Quality** to support safe patient care
- **Productivity** to streamline logistics flow

6 **Modelling** the logistics flow

Proof-of-Concept:

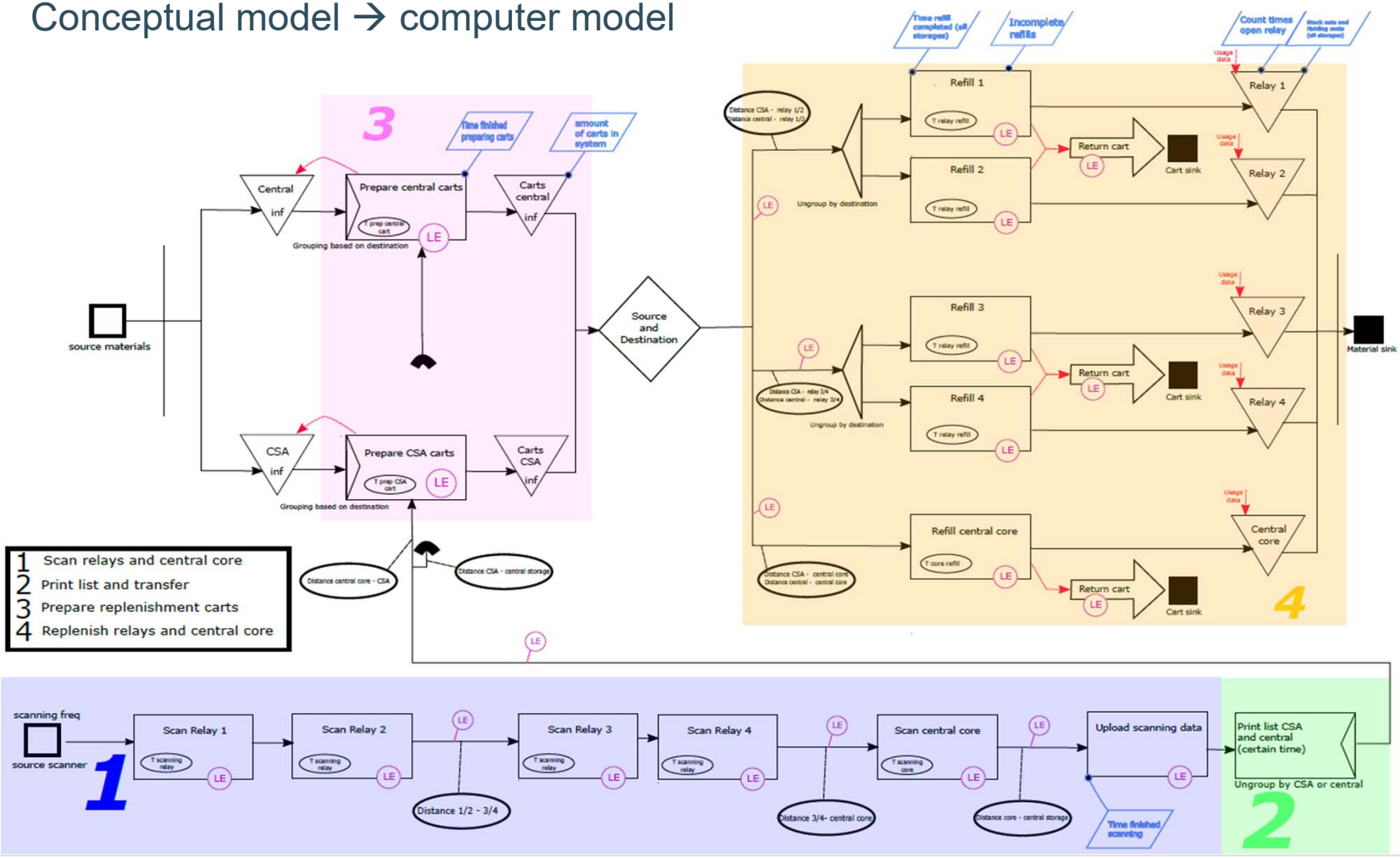
"How does SCM contribute to value-based healthcare?"

Discrete-Event Simulation (DES)

- Flexibility, variability and complexity
- Scenario analysis: simultaneously monitoring KPIs
  - ❖ Operational decision support
- Visualization power
  - ❖ Understanding > awareness > commitment > impact

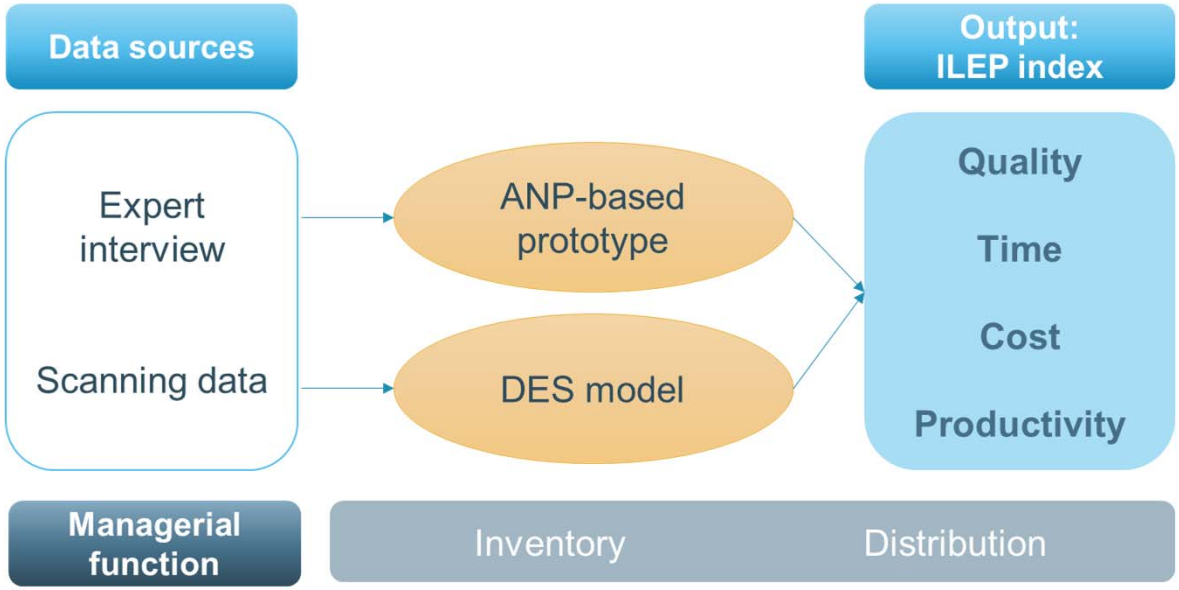
Case study – Materials replenishment flow at the OR

Conceptual model → computer model



7 Interpreting the **ILEP index**

Hybrid ANP-DES tool to support SCM policy decision making



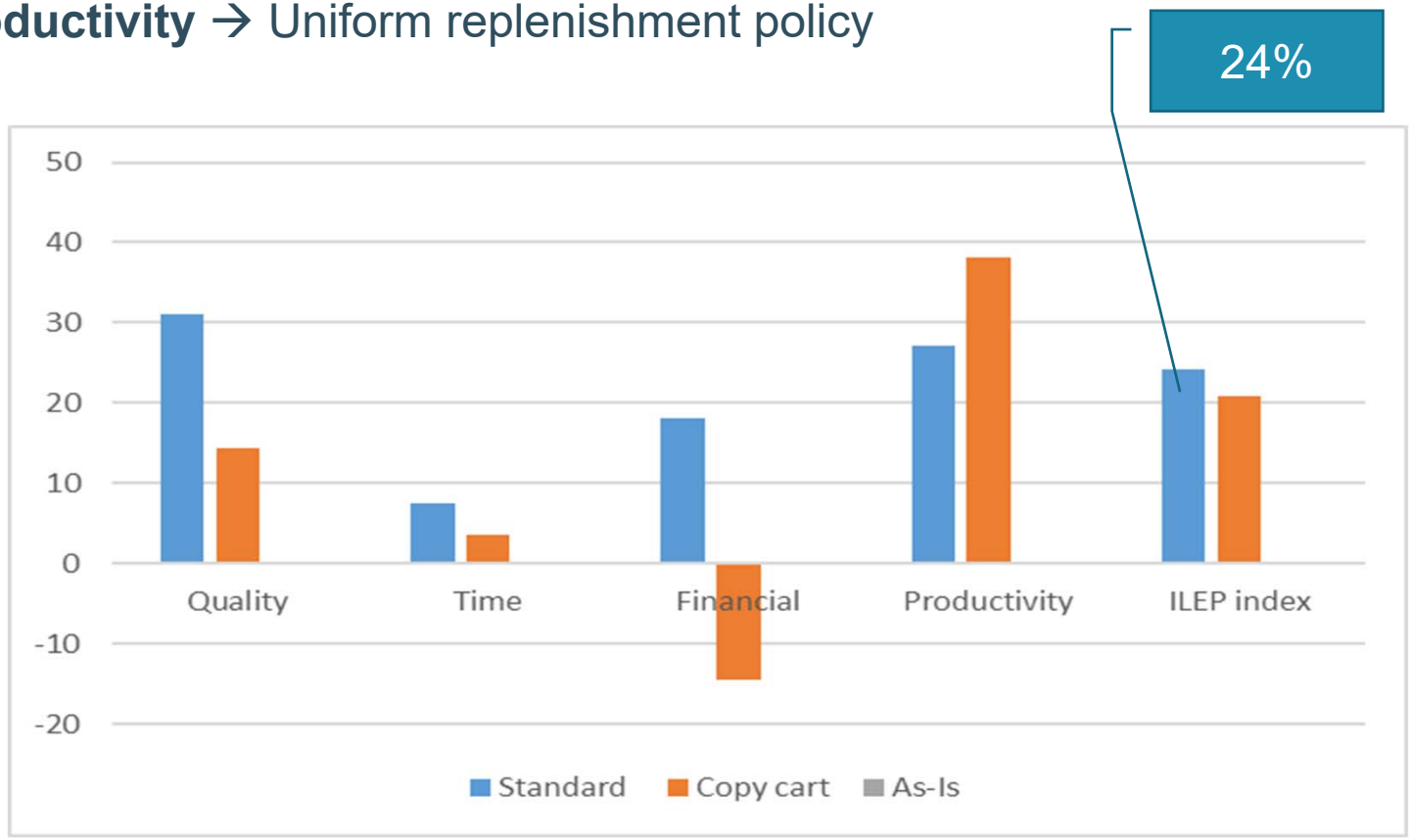
➔**Internal Logistics Efficiency Performance (ILEP) index**

- Multi-dimensional evaluation tool
- Quantify trade-offs >>> reduce fragmentation

Case study – Materials replenishment flow at the OR

Quality → Guarantee supply availability

Productivity → Uniform replenishment policy

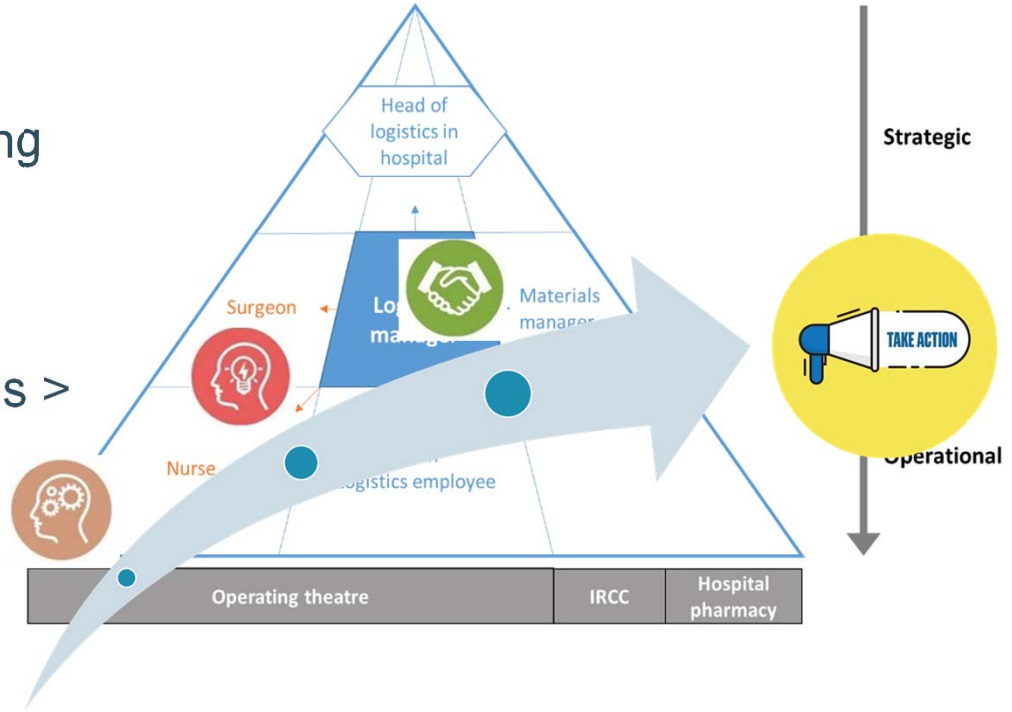


8 Sharing information between stakeholders

Single decision maker 

Multi-stakeholder multi-level framework

- Robust framework:
  - ❖ Tailored to healthcare setting
- Stakeholder education:
  - ❖ Understanding > awareness > commitment for change management

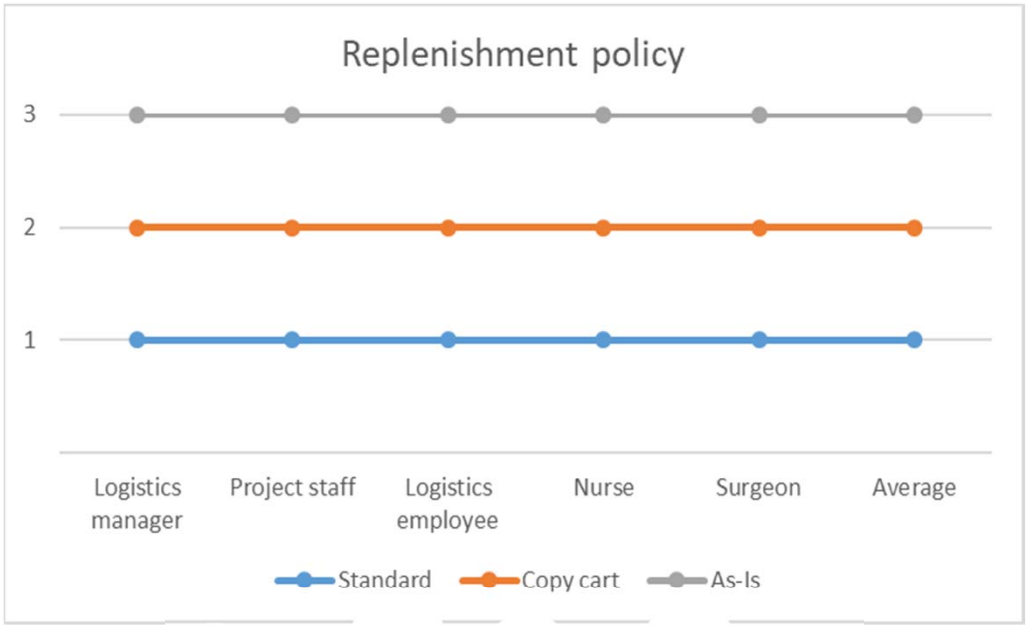


9 Choosing the **best logistics policy**

Multi-stakeholders repeat step 3

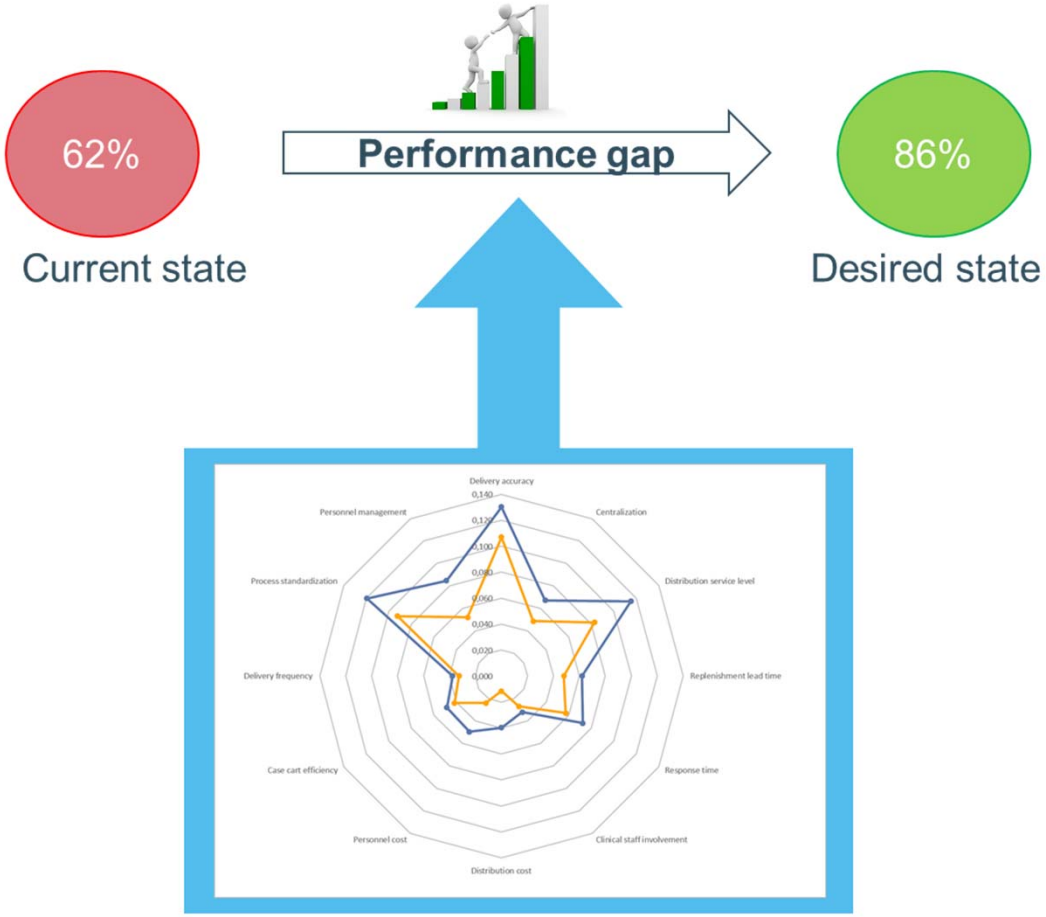
- Generic ANP ranking for operational excellence

Step 7: ILEP index indicates best policy tailored to healthcare context



10 Benchmarking

Continuous improvement



Performance gap analysis:

- Identify data requirements for monitoring KPIs
- Essential for model input

Uniform performance measurement

- Benchmarking between hospital departments
- Learn from best practices

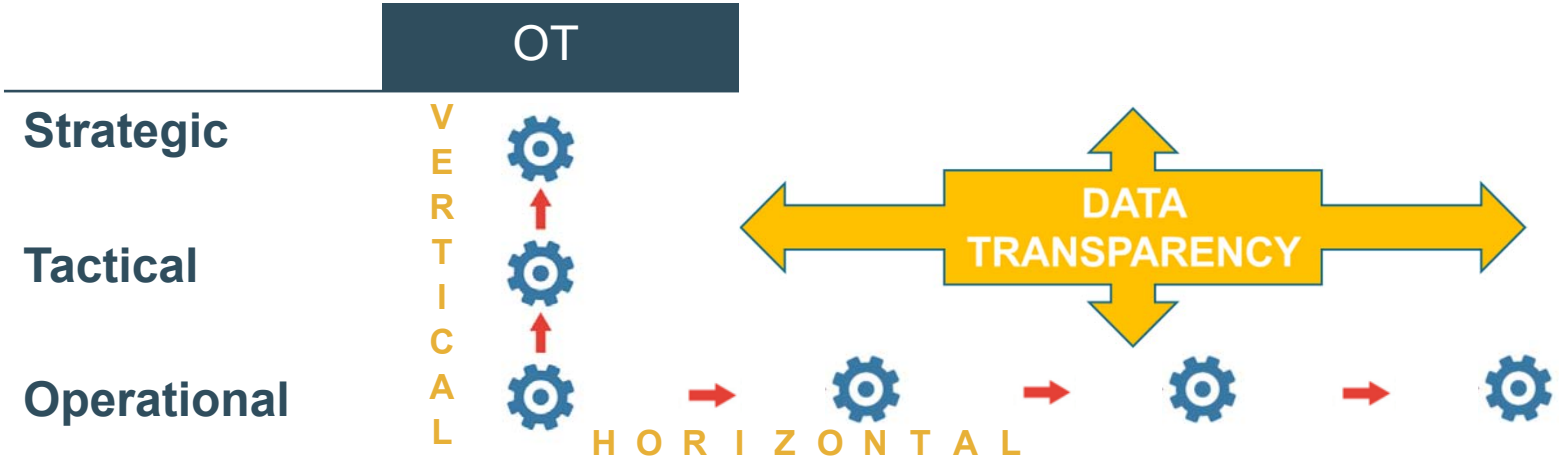
Supply chain integration

Vertical – individual department

- Common vocabulary for stakeholders

Horizontal – hospital wide

- Information-sharing through stakeholder education
- Transparent way of measuring operational excellence



Main insights

PhD contribution

Value-based care: Need for data-driven process improvement

Healthcare logistics performance management framework

➔ Proof-of-concept: *"How logistics contributes to healthcare?"*

Unique challenges to implementing SCM in healthcare:

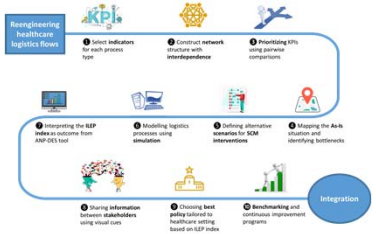
- Reduce supply chain fragmentation
  - ❖ Shared goal to maximize value
- Common language for stakeholders
- Data transparency

Orchestrator for an **integrated healthcare supply chain**

Future perspectives

Implementation

- Include other managerial functions
- Generic modules



Benchmarking

- Process reengineering
- Best practices

Supply chain integration

- Information technology systems
- Standardization

Technological enablers

- Barcoding, RFID
- Digital trends: AI, IoT

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Thank you for your attention!