



QUANTIFYING THE BENEFITS OF A MULTI-ECHELON INVENTORY APPROACH

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Data2Move event

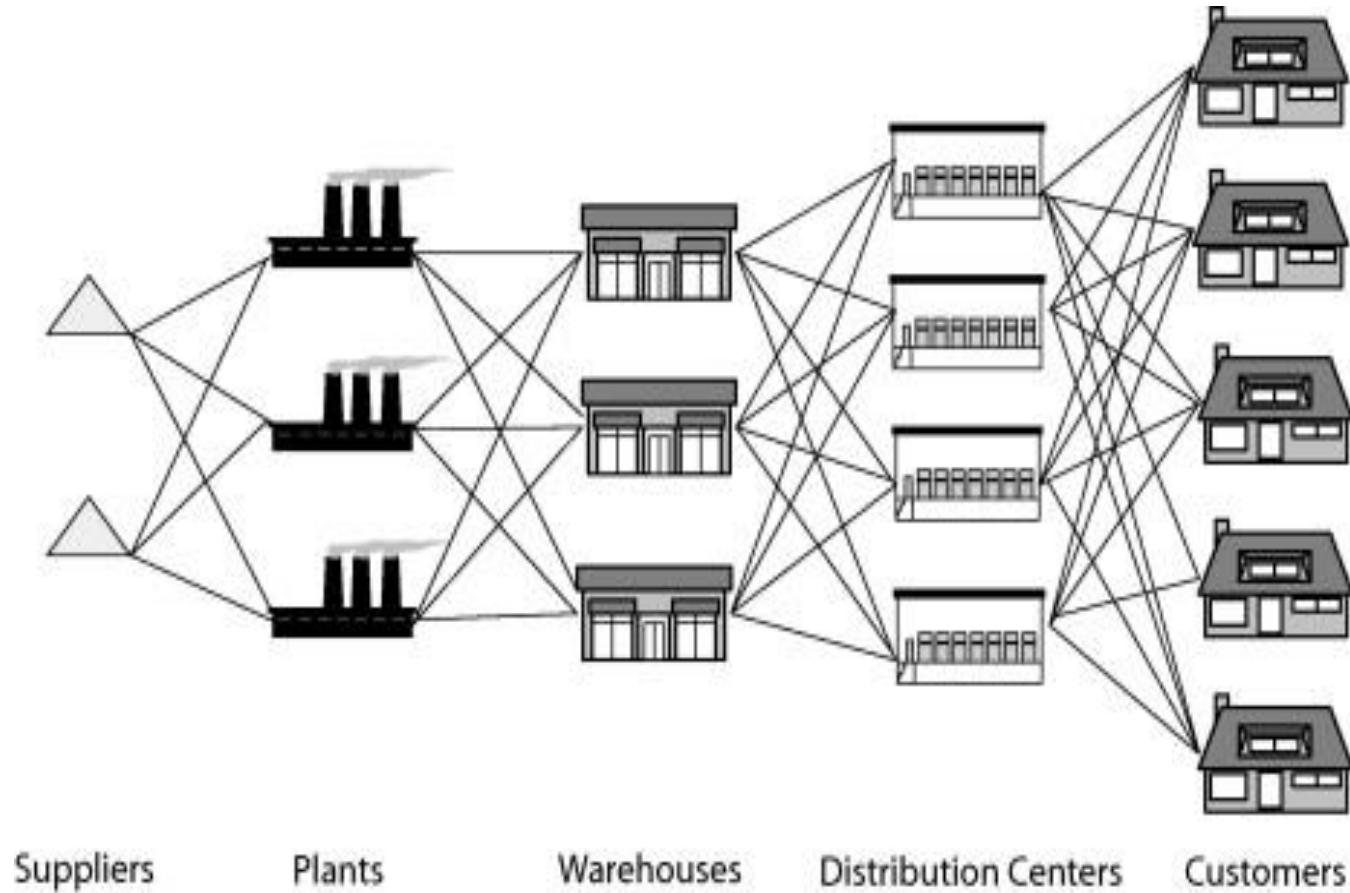
May 14th

WHAT YOU CAN EXPECT

- **Multi-echelon inventory management: the basics**
- **Real-life applications**
- **Challenges**
- **My research**
- **Findings in literature**
- **What do you think?**

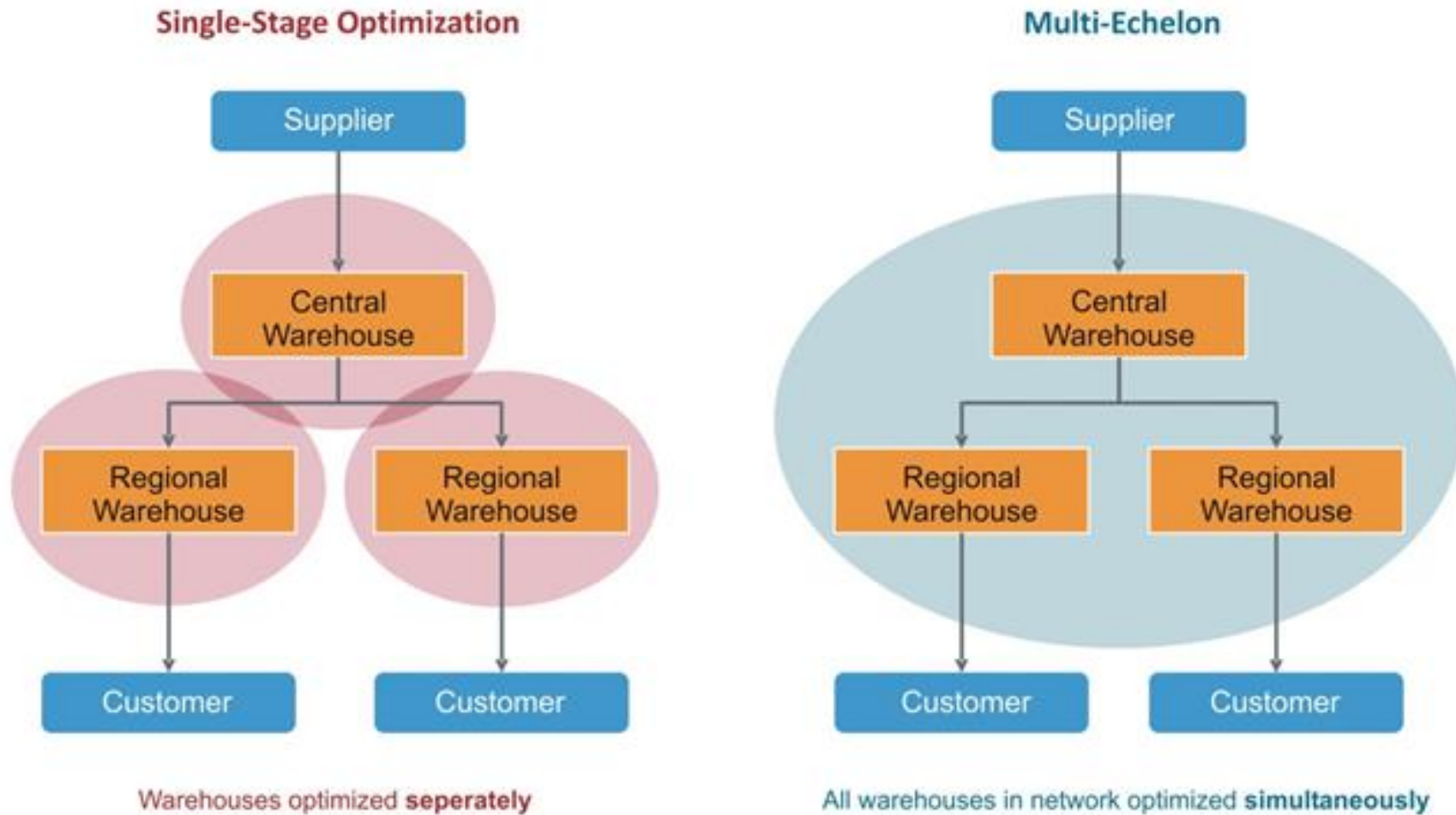
MULTI-ECHELON INVENTORY MANAGEMENT: THE BASICS

A MULTI-ECHELON SUPPLY CHAIN NETWORK¹



¹ Gumus, A. T., Guneri, A. F., & Ulengin, F. (2010). A new methodology for multi-echelon inventory management in stochastic and neuro-fuzzy environments. *International journal of production economics*, 128(1), 248-260.

WHAT IS MULTI-ECHELON INVENTORY MANAGEMENT?



REAL-LIFE APPLICATIONS

THIS SOUNDS AMAZING!

Do you know a company/supply chain with a multi-echelon inventory approach?

APPLICATIONS IN PRACTICE

- High potential according to academics
- < 5% of 394 papers with real-world application²

Example

- 30% with a multi-echelon approach
- 7% average inventory reduction³



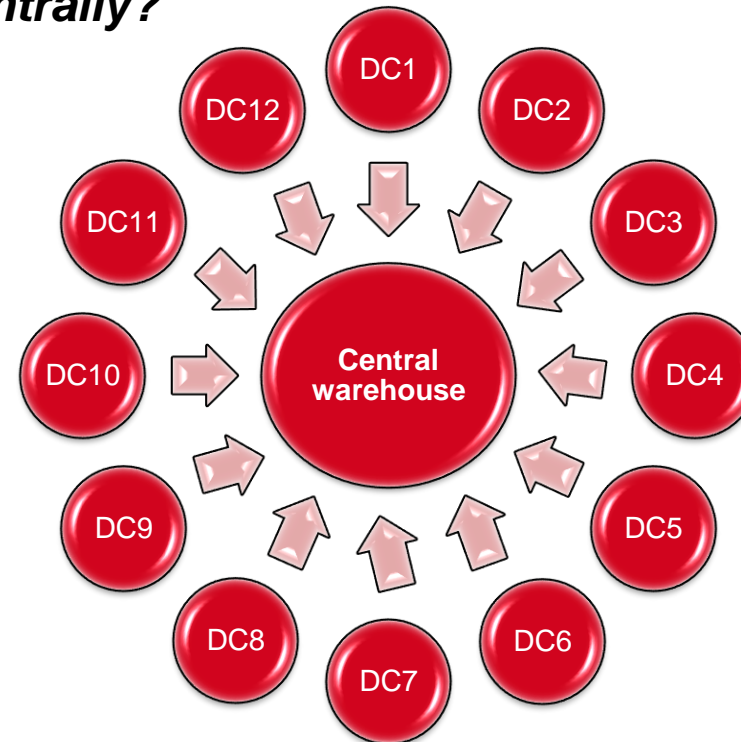
2 de Kok, T., Grob, C., Laumanns, M., Minner, S., Rambau, J., & Schade, K. (2018). A typology and literature review on stochastic multi-echelon inventory models. *European Journal of Operational Research*, 269(3), 955-983.

3 Farasyn et al. (2011). Inventory optimization at Procter & Gamble: Achieving real benefits through user adoption of inventory tools. *Interfaces*, 41(1), 66-78.

CHALLENGES

CHALLENGE 1: DATA COLLECTION AND PROCESSING

How do I ever collect all the required data centrally?



CHALLENGE 2: CENTRALIZED CONTROL

- *Who is responsible?*
- *How to share the benefits?*
- *How to measure performance?*



IMPORTANT QUESTIONS FROM A COMPANY PERSPECTIVE

Potential

- What is the potential inventory reduction? €€
- Can we improve the customer service level? 😊

Required effort

- How to overcome technical and organizational challenges?
- For which products should we change to multi-echelon?

MY RESEARCH

RESEARCH QUESTION

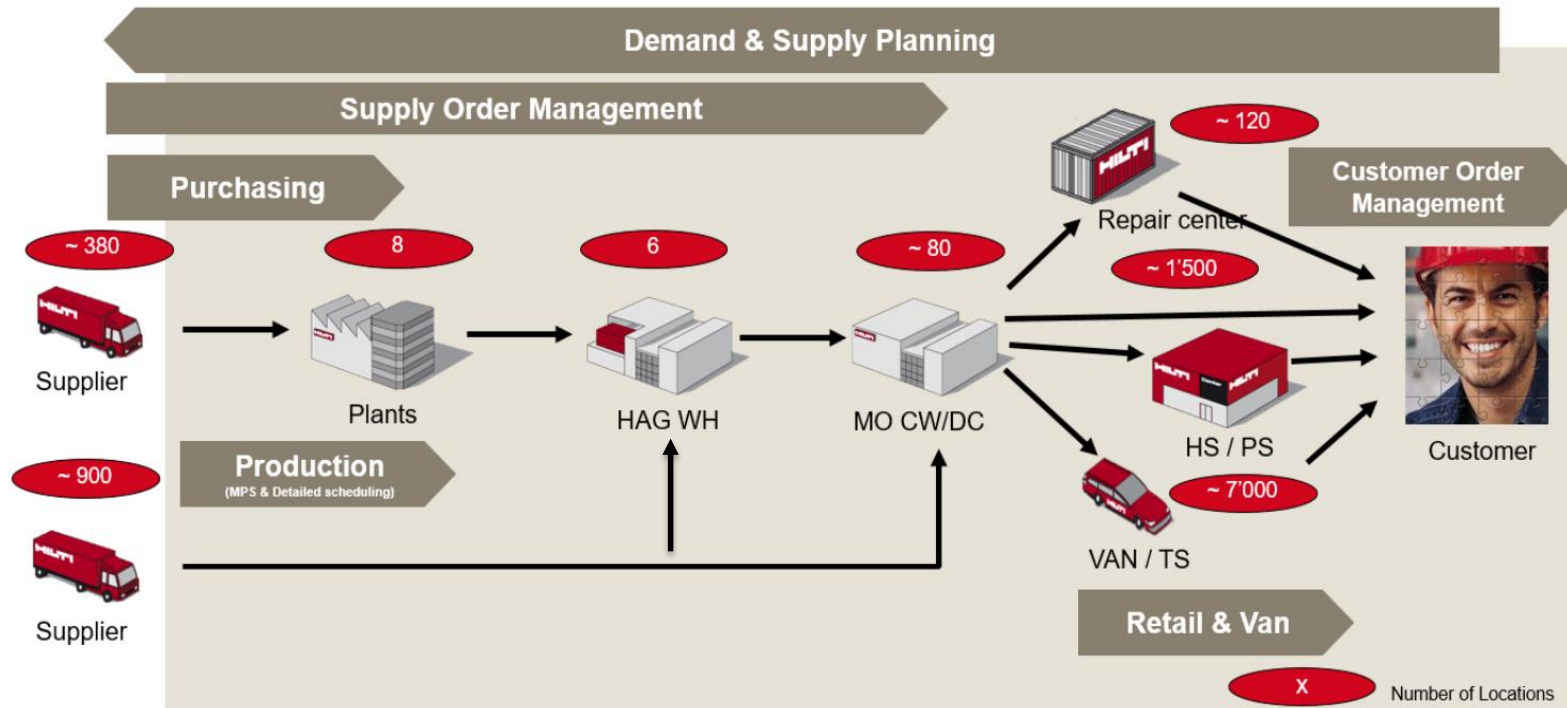
Under which product/supply chain characteristic settings does a multi-echelon inventory policy outperform a local policy?*

- Demand
- Demand variability
- Lead-time
- Lead-time variability
- Holding costs

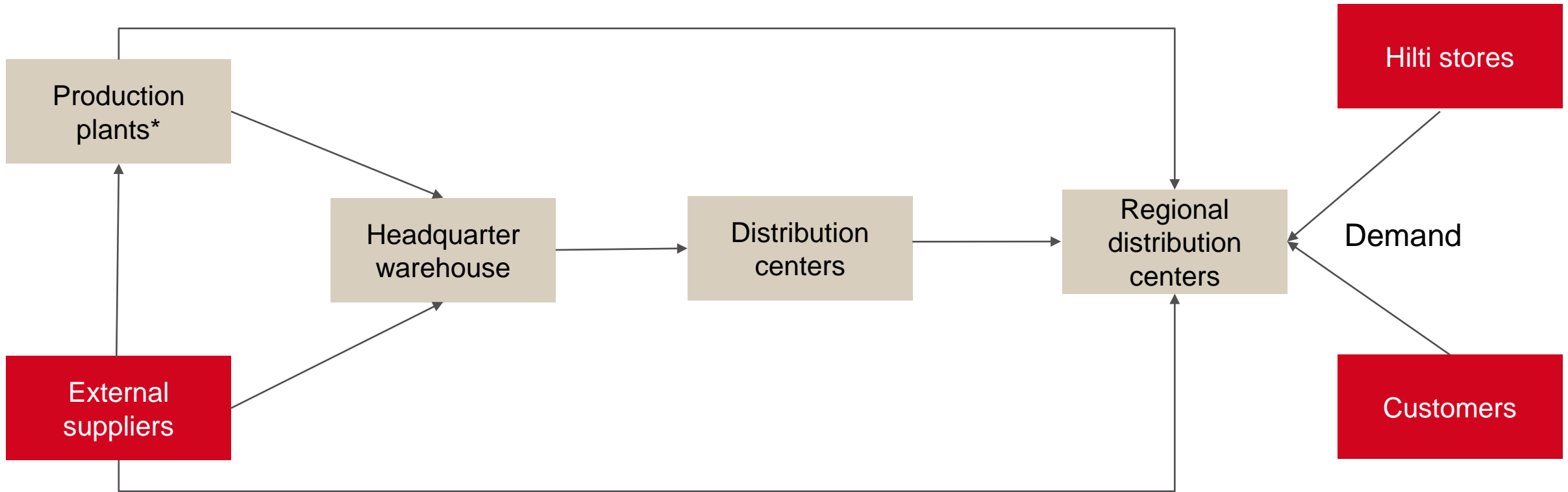
- **Result**

A framework that indicates under which supply chain characteristic settings multi-echelon approach outperforms local approach

HILTI'S SUPPLY CHAIN



PROJECT SCOPE: DISTRIBUTION NETWORK



In scope

Out of scope

*Finished goods only

SCENARIO EXAMPLE

Characteristic	Value	Service to the customer	Inventory reduction
Demand	Low	Local approach	Local approach
Demand variability	High		
Lead-time	Low	Multi-echelon approach	Multi-echelon approach
Lead-time variability	High		
Holding costs	High		
		Difference	Difference

THE ROLE OF THE CUSTOMER

Customer service level target is the driving force of parameter setting in inventory models

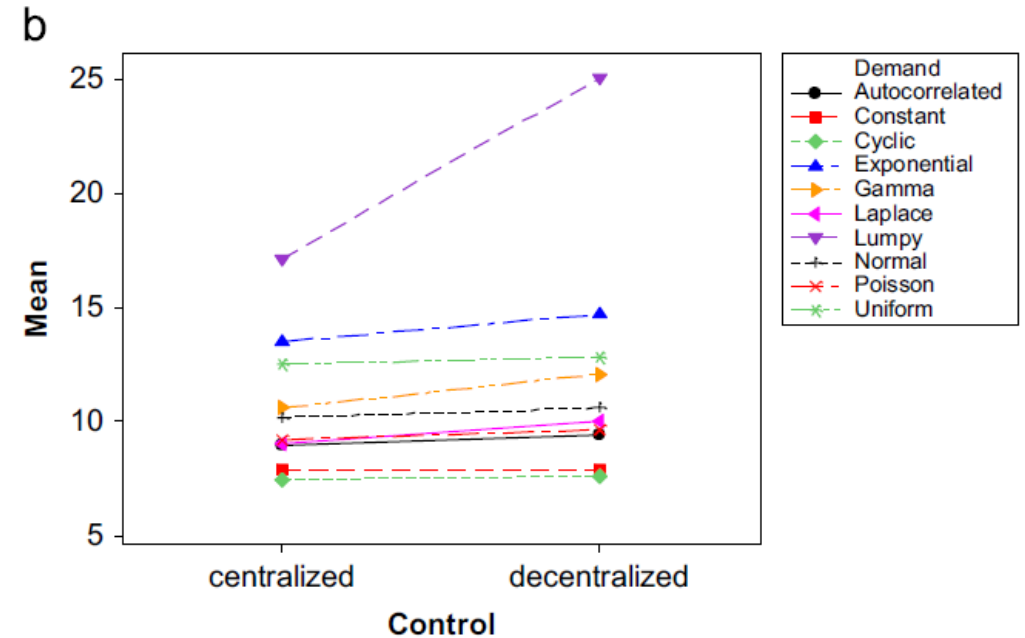
Scenario 1

Service level	Local approach	Multi-echelon approach
95%	?	?
98%	?	?
99%	?	?

FINDINGS IN LITERATURE

FINDINGS IN LITERATURE: DEMAND

- Unstable demand patterns → benefits higher⁴



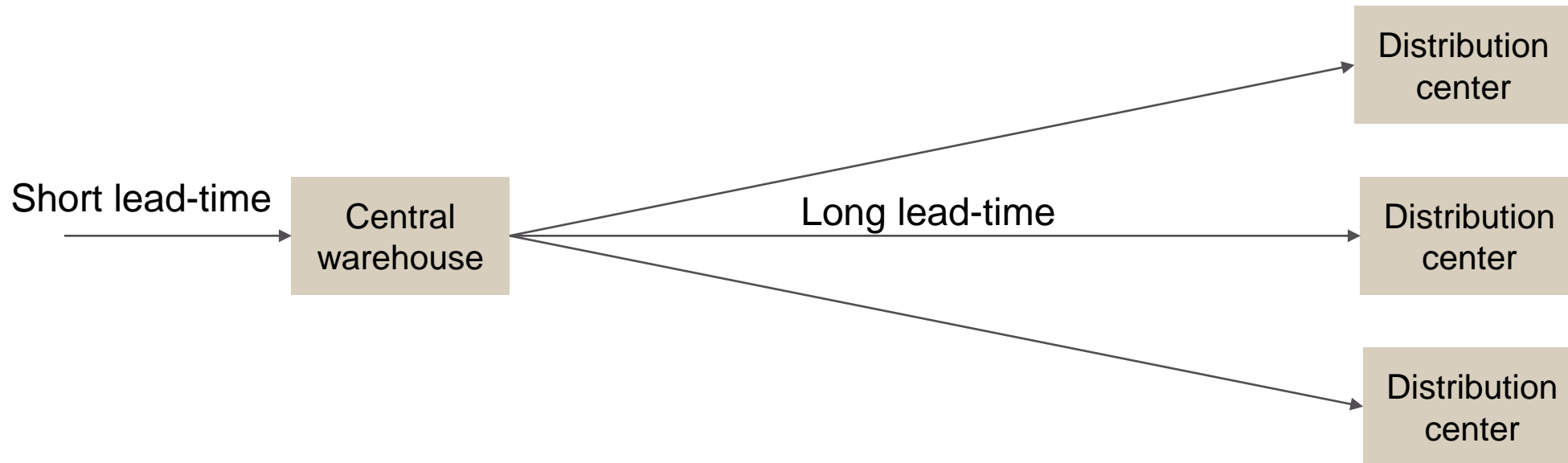
- The more low-demand items → the more important multi-echelon approach⁵

4 Duan, Q., & Liao, T. W. (2013). Optimization of replenishment policies for decentralized and centralized capacitated supply chains under various demands. *International Journal of Production Economics*, 142(1), 194-204.

5 Muckstadt, J. A., & Thomas, L. J. (1980). Are multi-echelon inventory methods worth implementing in systems with low-demand-rate items? *Management Science*, 26(5), 483-494.

FINDINGS IN LITERATURE: LEAD-TIME

Distribution system where orders are placed in batches



Installation (local) policy performs better than echelon policy⁶

WHAT DO YOU THINK?

WHAT DO YOU THINK?

The future will show whether your expectations can be fulfilled and your guess is correct..

THANK YOU

