Introduction

Logistics and Supply Chain Analytics

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Outline

- What is supply chain management?
- A framework for supply chain design
- Administrative information

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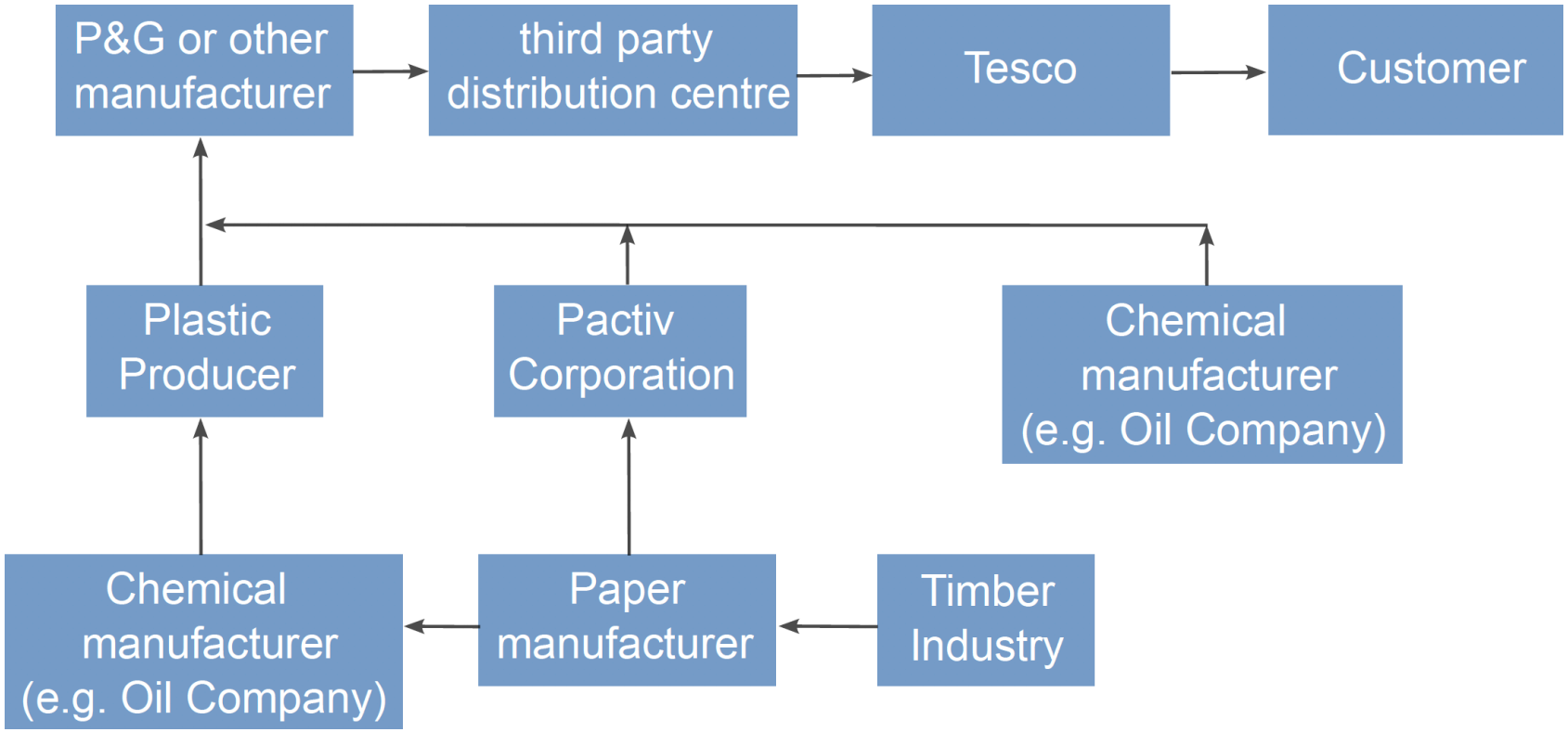
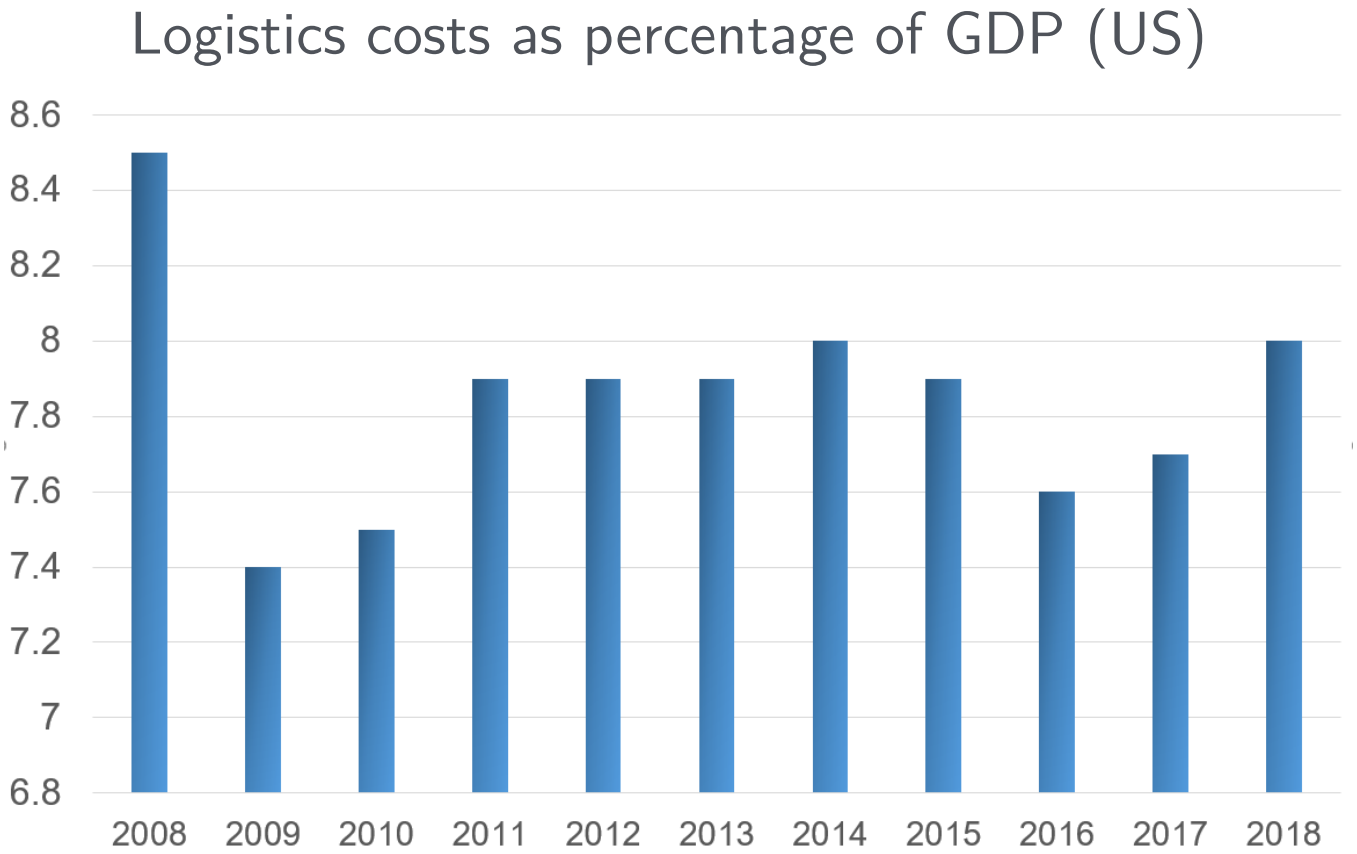
What is a Supply Chain?



An Example: Amazon.com, Inc.

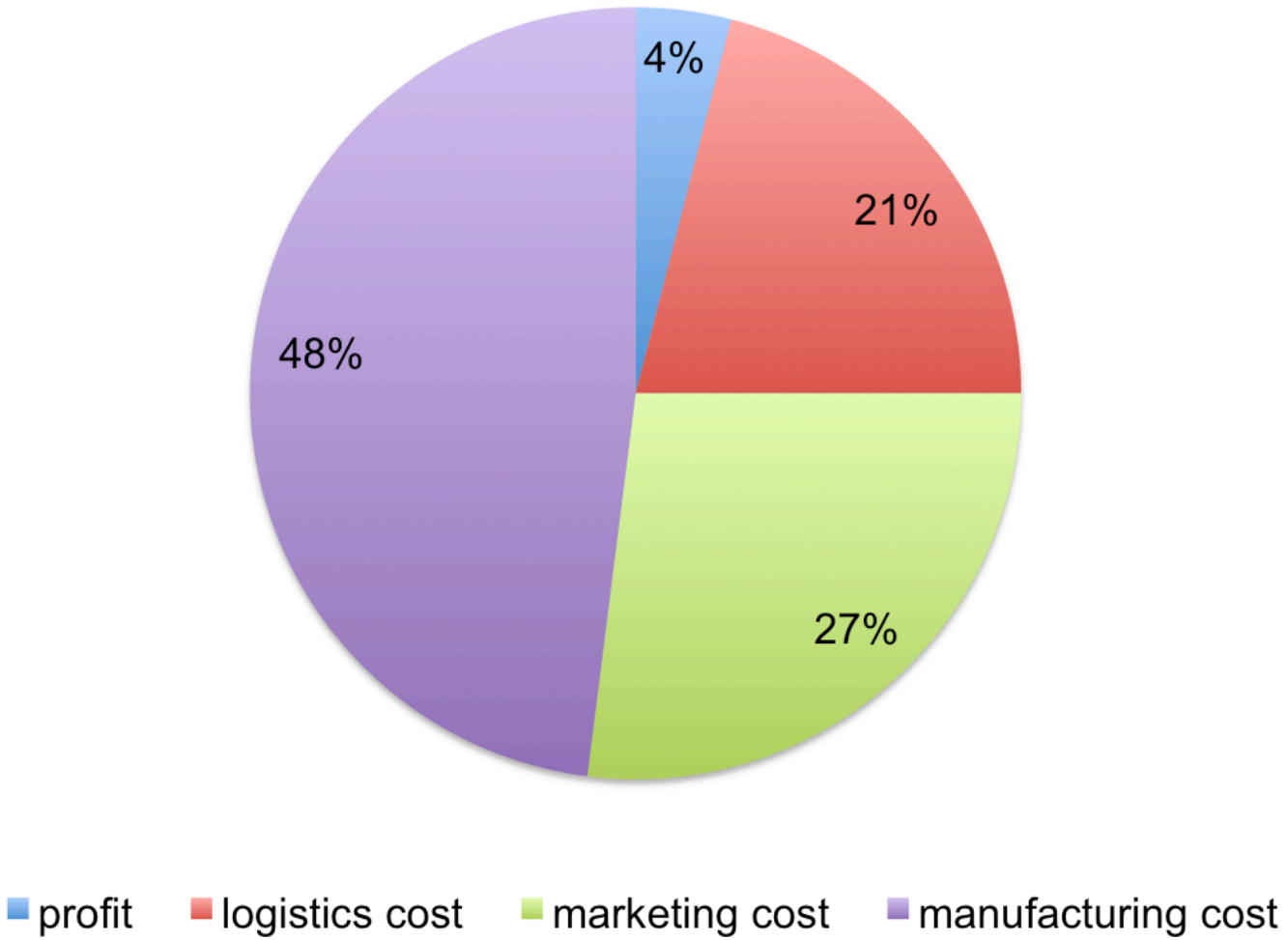
- The largest electronic commerce retailer in the United States, surpassed Walmart as the most valuable retailer by market capitalization in 2015
- Supply chain of Amazon consists of
  - Manufacturers $\rightarrow$ fulfillment centers $\rightarrow$ customers
- Fulfillment centers lie at the core of Amazon.com's business
  - Provide warehousing and order-fulfillment for Amazon.com
  - Third-party sellers can also use fulfillment centers (Fulfillment by Amazon or FBA service) for an extra fee

Logistics in the Economy



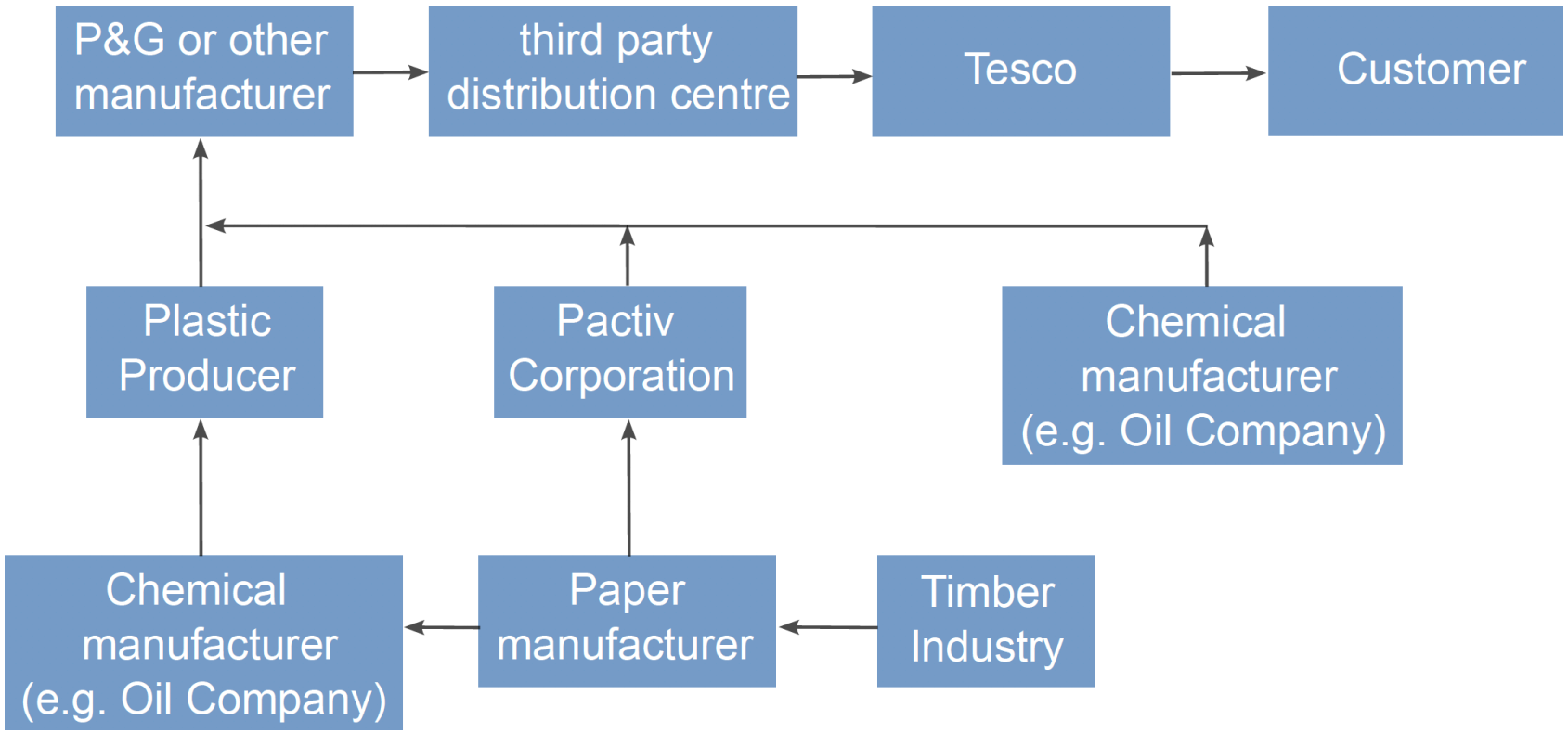
- Logistics cost breakdown
  - Freight Transportation: 60%
  - Inventory Expense: 35%
  - Administrative Expense: 5%

Logistics in the Manufacturing Firm



What is Supply Chain Management?

Managing supply chain flows (product, information, funds) to maximize supply chain surplus.



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A Supply Chain Management Framework

1. Strategic position: how to compete & what value to provide to customers?
    - Implied uncertainty
2. Supply chain capabilities: given strategic position, what must operations do very well?
    - Efficiency vs. responsiveness
3. Supply chain design and operating policies: how to achieve the required capabilities to support the desired strategy?
    - Facilities, inventory, transportation, information, sourcing, pricing

Achieving Strategic Fit: Understanding Customers

Targeted customer needs with respect to

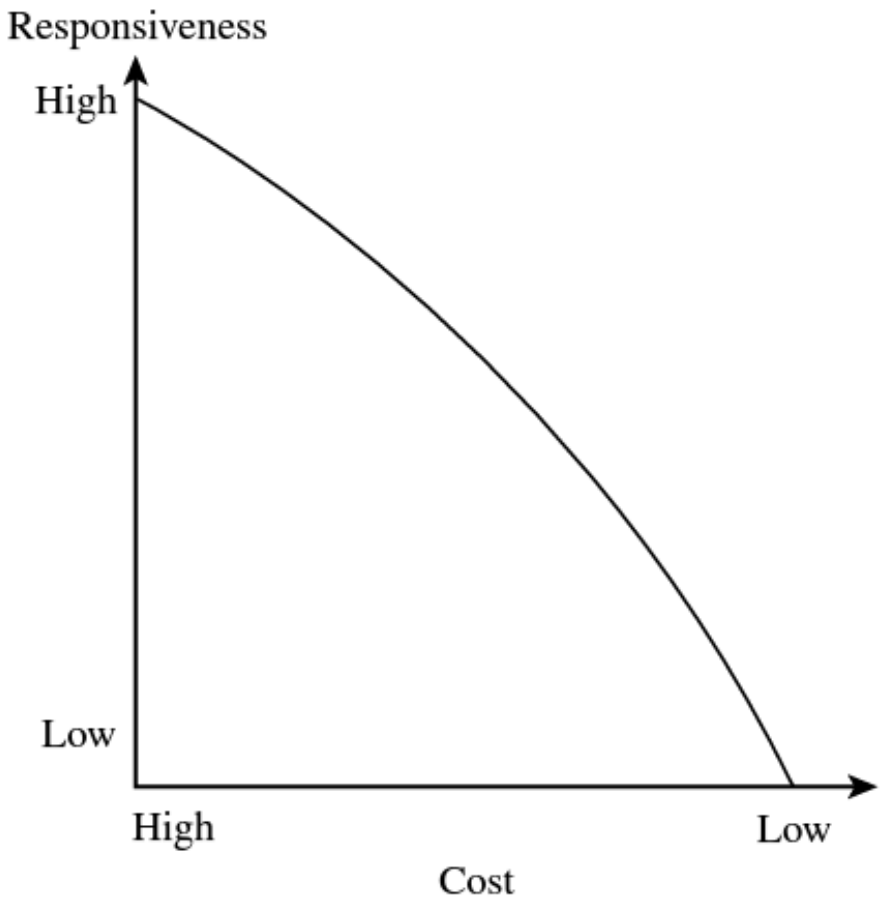
- Order quantity
- Response time
- Service level
- Product variety
- Price

Implied Demand Uncertainty

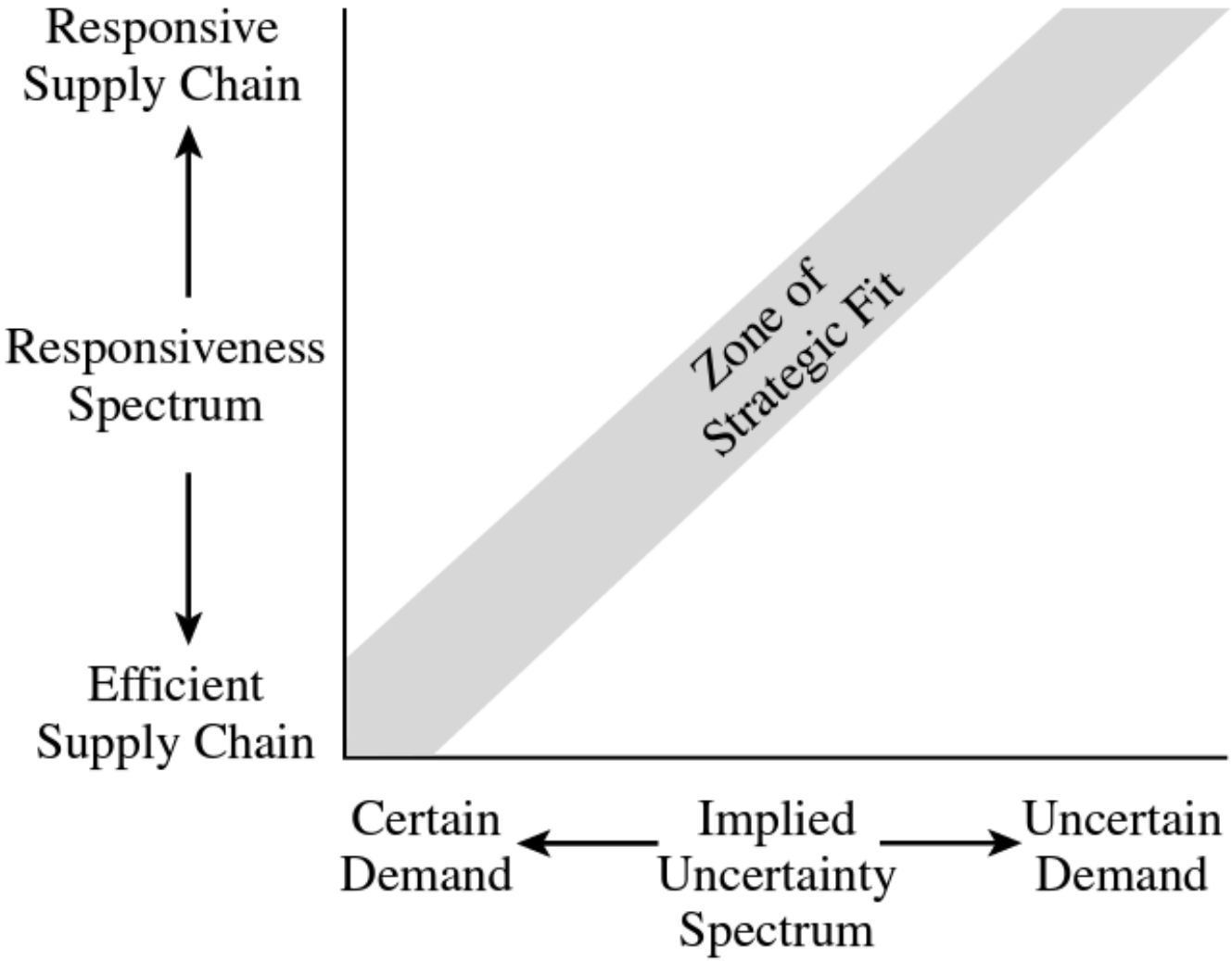
Supply Uncertainty

- Low supply uncertainty
  - Detergent and other consumer goods
- High supply uncertainty
  - Semiconductor components
  - Agriculture output
  - ⋮

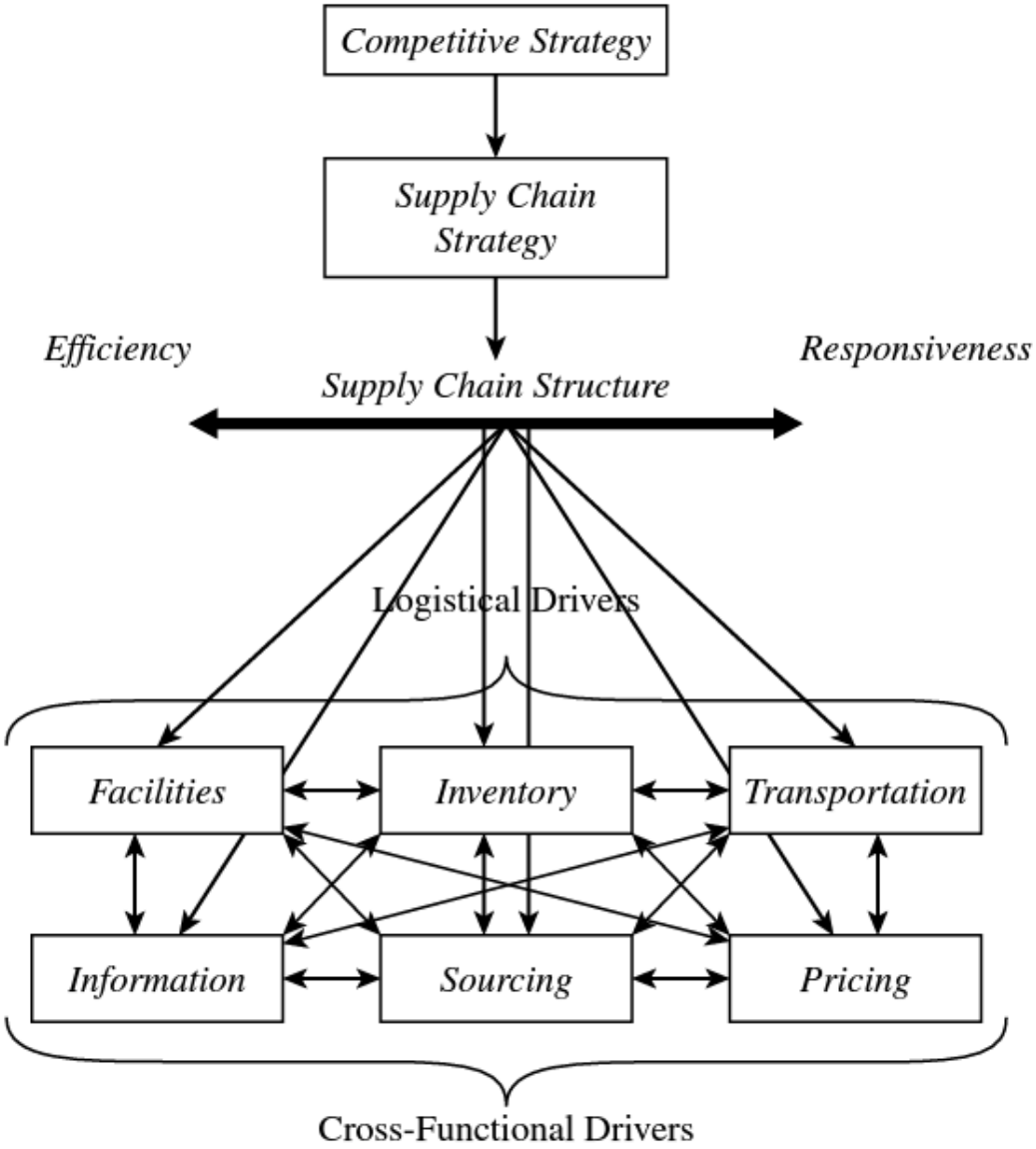
Achieving Strategic Fit: Cost-Responsiveness Efficient Frontier



Consistency Between Implied Uncertainty & Supply Chain Responsiveness



Structuring & Managing the Supply Chain Drivers to Deliver Capabilities



Summary

- Goal of supply chain management is to increase supply chain surplus by appropriately managing information, product, and financial flows and assets
- Framework for supply chain design: Importance of fit
  - Priorities of business strategy (implied uncertainty)
  - Targeted supply chain capabilities (efficiency vs. responsiveness)
  - Supply chain performance drivers
- Key: How to design the supply chain to achieve capabilities tailored to a range of requirements while realizing possible efficiencies?

A Case Study: Lidl and Aldi

1. What values do "hard discounters" provide to customers?
2. Given value/strategic position, what must supply chain do very well? Efficiency or Responsiveness?
3. How to design supply chain performance drivers to achieve the required capability?
    - Facilities, inventory, transportation, information, sourcing, pricing

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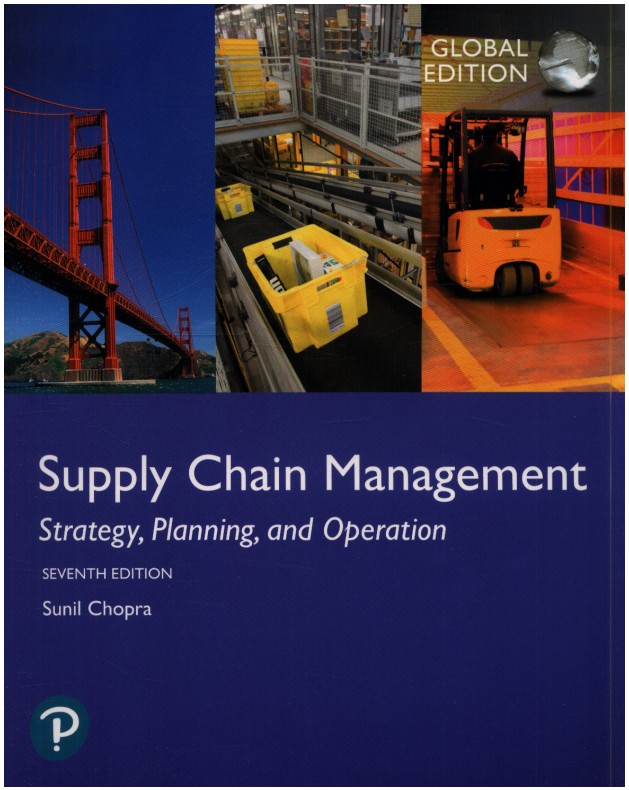
Topics to be covered

- Demand forecasting
  - Univariate time series analysis
    - ARIMA model
    - Holt-Winters exponential smoothing
  - Econometrics models
- Inventory management
  - Deterministic part: economic order quantity (EOQ)
    - Methodology: mixed-integer linear programming; heuristics
  - Stochastic part: safety inventory; optimal product availability
    - Methodology: Monte Carlo simulation

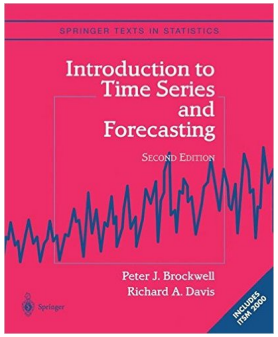
Reference Books

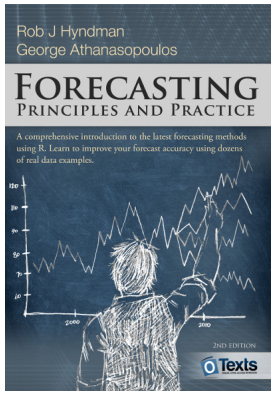


- Supply Chain Management: Strategy, Planning and Operation
  - The main reference book
  - Covers a wide range of topics in supply chain management, accompanied with real-world examples

Reference Books

- Time series analysis
  - Introduction to time series and forecasting, by P. Brockwell and R. Davis
  - Forecasting: Principles and practice, by R. Hyndman and G. Athanasopoulos





Miscellany

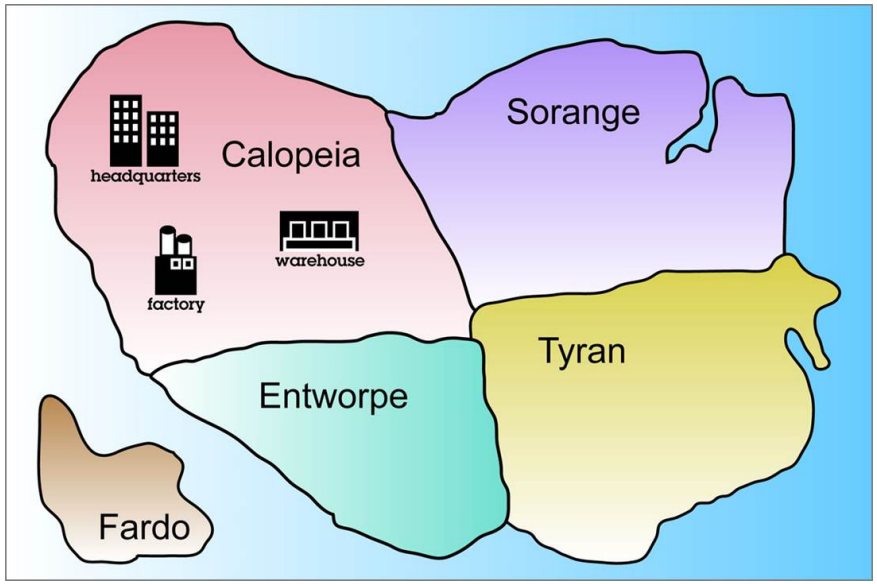
- Classroom etiquette
  - Please turn on your camera if possible
  - Only unmute yourself if you want to ask a question
- If there is anything you want to discuss,
  - post questions on Forum
  - send me an email
  - weekly office hour (3-4pm, every Friday)

Assessment

- Individual coursework (50%)
  - Data provided by one of the largest fast-food restaurant chains in the US
    - transaction information
    - ingredient lists
  - Observation window: Early March, 2015 to 06/15/2015
  - Your job: Forecast daily demand of ingredient lettuce for two weeks
  - A written report due on March 15th

Assessment

- Group coursework (50%) - a supply chain simulation game



  - One single firm producing a single product (drums of a chemical) for regional markets
  - Determine facility and inventory policies to satisfy demand for the next two simulated years

- A written report due on April 7th