Supply Chain Videocast

Operations Rules 2012

Part 3: Managing Complexity Through Long Tail Analysis
Part 1: Mitigating Supply Chain Risk/New Risk Exposure Index
  • Now Available On-Demand

Part 2: Supply Chain Segmentation for Improved Profitability
  • Now Available On-Demand

Part 3: Managing Complexity through Long Tail Analysis

On-Demand Videocasts at www.scdigest.com/supply_chain_videocasts.php
Complexity Management: Long Tail Analysis

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Supply

Sources:
- plants
- vendors
- ports

Regional Warehouses:
- stocking points

Field Warehouses:
- stocking points

Customers, demand centers sinks

Production/purchase costs

Inventory & warehousing costs

Transportation costs

Inventory & warehousing costs

Transportation costs

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The Enterprise
Fulfillment and Development Supply Chains

Plan/Design

Source

Supply → Produce → Distribute → Sell

Product Architecture
Make/Buy
Early Supplier Involvement

Strategic Partnerships
Suppliers Selection
Supply Contracts

Development Supply Chain

Fulfillment Supply Chain

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Complexity and its Challenges

• Development Supply chain
  – Hundreds of products
  – Thousands of suppliers

• Fulfillment Supply chain
  – Multiple channels
  – Customers in different regions
  – Different packaging and labeling
  – Many facilities

• The impact of complexity
  – Forecast accuracy
  – Service level
  – Inventory levels
  – Cost (set-ups, inventory, ...) and margins
Complexity and its Challenges

- Development Supply chain
  - Hundreds of products
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- Fulfillment Supply chain
  - Multiple channels
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- The impact of complexity
  - Forecast accuracy
  - Service level
  - Inventory levels

Our objective is to understand the hidden cost of complexity and identify effective ways to manage it
What We’ll Cover …

- **The Curse of Variability**
  - Drivers and Impact
- **Matching Products and Strategies**
  - Push-Pull Supply Chains
- **Complexity Management**
  - The Long Tail Approach
- **Summary**
Demand variability & uncertainty complicate operations and supply chain strategy and planning

The Bullwhip Effect:
- Order Variability is amplified up the supply chain
- Upstream echelons face higher variability

Retail sales versus Orders to PC Manufacturers
What are the Causes....

- Promotional sales
- Volume and Transportation Discounts
- Inflated orders
- Demand Forecast
- Long cycle times
- Lack of visibility
Consequences....

• Increased safety stock

• Reduced service level

• Inefficient allocation of resources

• Increased transportation costs
What We’ll Cover …

• The Curse of Variability
  ◦ Drivers and Impact

• Matching Products and Strategies
  ◦ Push-Pull Supply Chains

• Complexity Management
  ◦ The Long Tail

• Summary
Matching Supply Chain Strategies with Products

- **Pull** strategies tend to have lower delivery costs and higher unit prices, as well as lower uncertainty in demand.
- **Push** strategies are typically associated with higher delivery costs and lower unit prices, but they may also benefit from economies of scale.

The diagram illustrates how different products (e.g., Dell, Zara, Amazon, Campbell's, Luvs) are strategically placed based on their demand uncertainty (C.V.) and unit price.

- **Economies of Scale** can be achieved in the **Push** quadrant, where large volumes of low-cost products are manufactured and distributed.

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Matching Supply Chain Strategies with Products

Demand uncertainty (C.V.)

Push

Pull

Pull

Push

H

L

Peapod

Dell

Zara

amazon.com

III

IV

I

II

Delivery cost

Unit price

Economies of Scale

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Matching Supply Chain Strategies with Products

Push

Demand uncertainty

REDUCE COMPLEXITY

2010 2014 2018

30 24 14

Peapod amazon.com

Pull

L

Economies of Scale

Number of Engine Platforms

2009 2012 2015 2018 Goal

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What We’ll Cover …

• The Need to Focus
  ◆ Drivers and Impact

• Matching Products and Strategies
  ◆ Supply Chain Segmentation

• Complexity Management
  ◆ The Long Tail Approach

• Summary
Case Study: Steel Manufacturing Company

- Blast Furnace producing slabs
  - Currently slabs are produced using Make-to-Forecast
  - About 300 different articles defined by steel grade, width, weight, etc

- Slabs are shipped to manufacturing facility
  - Lead time of 8-9 weeks

- Rolling Operations
  - Slabs are hot or cold rolled into sheet metal or plates
  - Production Processing time is 3-4 weeks
  - Make-to-Order operations

Raw Materials
- Iron Ore & Carbon Coke

Blast Furnace
- 8-9 weeks

Rolling
- 3-4 weeks

Finishing
- Hot-rolled
- Cold-rolled

Final processing

End User
The Challenge

- Poor forecast accuracy:
  - During a six-month period, the average absolute relative forecast error (ARFE) was above 240%, while the weighted average ARFE was below 130%

- Low fulfillment accuracy:
  - During the same period of time, fulfillment accuracy was below 50%

- Higher cost:
  - Instability in the supply chain was driving material, manufacturing, and logistics costs up
The Long Tail: Orders Volume, Variability and Margins

Coefficient of Variation for Articles with Average Monthly Volume less than 5MM kg
(Bubble size represents the absolute value of variable margin)
The Long Tail: Orders Volume, Variability and Margins

Coefificient of Variation for Articles with Average Monthly Volume less than 5MM kg
(Bubble size represents the absolute value of variable margin)
The Long Tail: Orders Volume, Variability and Margins

- 19 articles (9% of total)
- They account for more than 50% of the volume
- These articles should be managed based on a Push-Pull strategy
- That build-to stock of articles and build-to-order of final products
- Compete on Time

Coeficient of Variation for Articles with Average Monthly Volume less than 5MM kg
(Bubble size represents the absolute value of variable margin)
The Supply Chain Strategy for the High Volume Low/Variability Articles

- 19 articles contributing more than 50% of the volume
The Supply Chain Strategy for the High Volume Low/Variability Articles

PUSH STRATEGY

Raw Materials
Iron Ore & Carbon Coke

Blast Furnace

8-9 weeks

PULL STRATEGY

Rolling

Finishing
Hot-rolled

Cold-rolled

3-4 weeks

Final processing

End User

Push-Pull Boundary

Keep Stock

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Many low volume, low margin, high variability articles

These are not productive articles

They are candidates for removal from the business
The Long Tail Approach

- Is there an opportunity to simplify by managing the tail?
- Does the long tail contribute significantly to revenue?
- Does the long tail include many low margin products?
- What is the hidden cost of products in the long tail?
Example 2: Demand, variability, and allocated margin

Case Study: High-Tech Company

Tail accounts for
- 35 % of products
- 1.4% of revenue
- 50% of the negative margin products

Allocated margin range
- 30-80%
- 0-30%
- Negative
- 80-90%
Example 2: Lead Time and the Long Tail

Tail accounts for
• 35 % of products
• 1.4% of revenue
• 50% of the negative margin products
• 60 % of total cost per unit sold

Rule: Products in the Long Tail are associated with Longer Lead Times than other products
The Impact of Product Life Cycle on Variability

Products in Early Life

- Coefficient of Variation (CV)
- Products: Product 1, Product 2

Products in End of Life

- Coefficient of Variation (CV)
- Products: Product 3, Product 4

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The Impact of Product Life Cycle on Variability

Rule: The tail is not Static—Products typically start at the tail and end at the tail.

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Variability Growth with the Number of Products
Variability Growth with the Number of Products

**Rule:** The more products you have the higher the variability
Example 3: The Long Tail Approach

Case Study: Foods Business

% Sales Contribution
- A = High, 21, 68%
- B = Medium, 32, 15%
- C = Low, 45, 7%

CoV of Sales (Mar-June’2010)
- Low, 21, 68%
- Medium, 32, 15%
- High, 45, 7%

CoV sales:
- Low: <= 20%
- Medium: 20%- 50%
- High > 50%

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Complexity Management: Important Findings

- Items in the tail accounts for more inventory per dollar revenue than other items due
  - High variability
  - Long lead times
    By a factor of three of more
- Variability during product lifecycle is high at
  - Product introduction
  - End-of-life
- Increasing the number of products increases variability for ALL existing products
- Complexity reduction starts at the product design stage
Dell Transformation Results

• >99% fewer configurations
• 3 times improvement in forecast accuracy

• >30% freight cost reduction on notebooks

• >30% manufacturing cost reduction
The Enterprise
Fulfillment and Development Supply Chains

Development Supply Chain

Plan/Design

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- Early Supplier Involvement

Source

- Strategic Partnerships
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- Supply Contracts

Supply ➔ Produce ➔ Distribute ➔ Sell

Fulfillment Supply Chain

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The Enterprise
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Need to understand the impact of New Product Introduction on the tail taking into account BOM, Volume, Cost, Lead Times… .

Fulfillment Supply Chain

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What We’ll Cover …

• The Need to Focus
  ◦ Drivers and Impact

• Matching Products and Strategies
  ◦ Supply Chain Segmentation

• Complexity Management
  ◦ The Long Tail Approach

• Summary
Key Observations

- **Complexity Management**
  - The Long Tail has a huge impact on supply chain performance
  - Managing complexity starts at the product design level
  - The benefits of lower variety include better forecast, higher service levels with lower inventory, higher margins
More Resources

- Dr. David Simchi-Levi, MIT
  - dslevi@mit.edu
- Operations Rules web site
  - www.oprules.com
- Dan Gilmore, SCDigest
  - dgilmore@scdigest.com